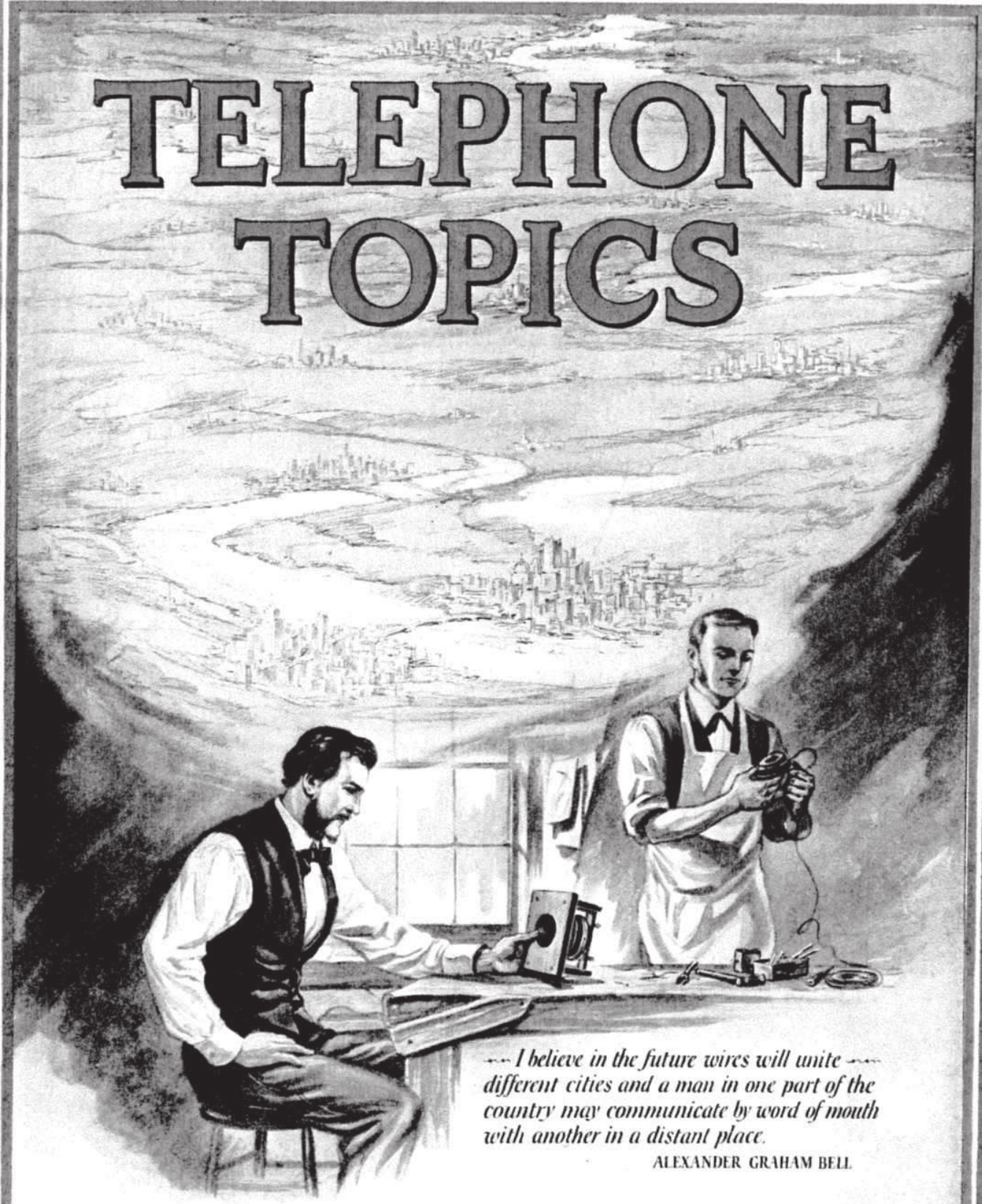
TELEPHONE TOPICS

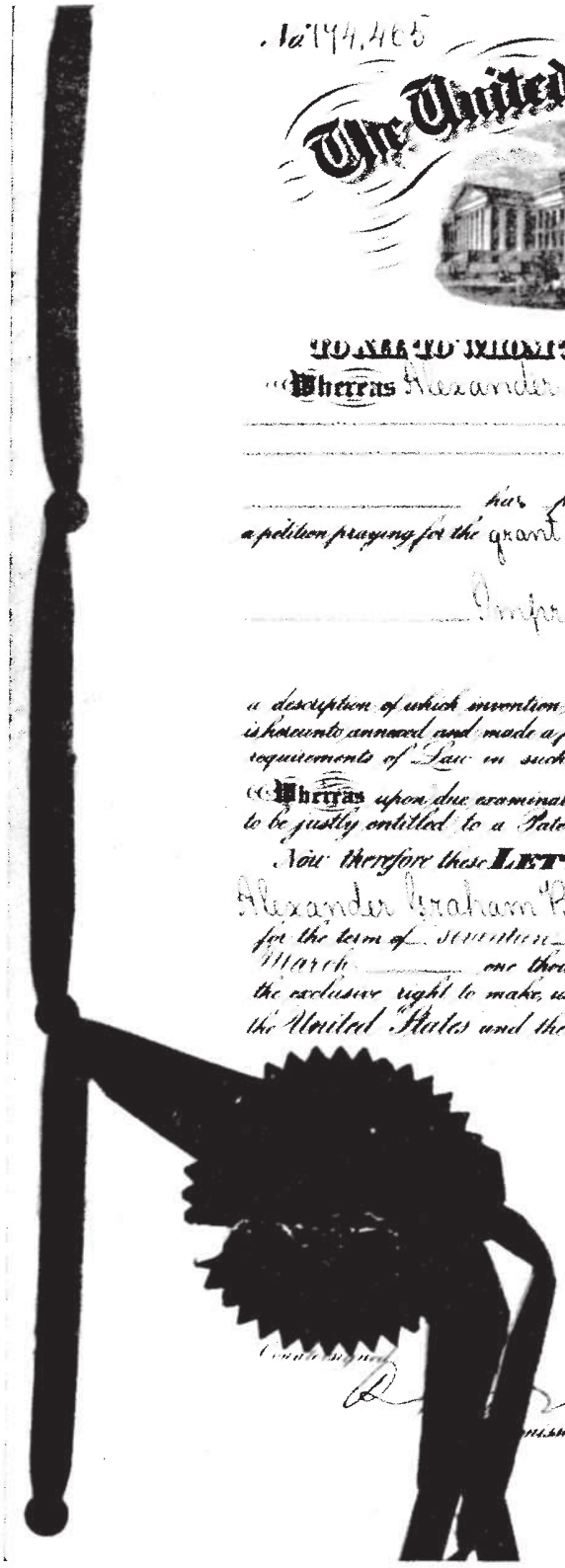


I believe in the future wires will unite different cities and a man in one part of the country may communicate by word of mouth with another in a distant place.

ALEXANDER GRAHAM BELL

FIFTIETH ANNIVERSARY OF THE TELEPHONE

1876 MARCH 1926



No. 174,465

The United States of America

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas Alexander Graham Bell, of Salem, Massachusetts

has presented to the Commissioner of Patents a petition praying for the grant of LETTERS PATENT for an alleged new and useful

Improvement in Telegraphy

a description of which invention is contained in the Specification of which a copy is hereunto annexed and made a part hereof, and has complied with the various requirements of Law in such cases made and provided, and

Whereas upon due examination made the said Claimant is adjudged to be justly entitled to a Patent under the Law;

Now therefore these LETTERS PATENT are to grant unto the said Alexander Graham Bell, his heirs or assigns for the term of Seventeen years from the Seventh day of March one thousand eight hundred and seventy six, the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof.

In testimony wherof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this Seventh day of March in the year of our Lord, one thousand eight hundred and seventy six and of the Independence of the United States of America the One hundredth.

Countersigned

Secretary of the Interior

Commissioner of Patents

BELL'S FIRST TELEPHONE PATENT
The most valuable patent ever granted and issued

VOL. XIX, No. 11 MARCH, 1926

TELEPHONE TOPICS

ISSUED MONTHLY BY THE NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY AND DISTRIBUTED WITHOUT CHARGE TO ITS EMPLOYEES AND TO THE EMPLOYEES OF CONNECTING COMPANIES
PUBLICATION OFFICE, 50 OLIVER STREET, BOSTON

Still Advancing!

1874—A dark-haired young man with flashing eyes working feverishly at night in the cellar of a Salem house in an effort to solve a problem.

1875—In the garret of a dingy shop in Boston the same young man continues his experiments, but now he has a younger assistant,—a mechanic who can interpret a vague idea and make things. The older man believes he can talk over a wire. In June they succeed in transmitting an almost inaudible sound.

1876—At last a patent is issued, but there is no name for the device. Then, three days later, it speaks a complete sentence.

1877—The telephone is developing. People talk about it. For months demonstrations are given to raise money. Then, in May, it becomes a commercial success. Three months later the first business organization is formed.

Almost four years of continuous application before success comes to Alexander Graham Bell. Then years of litigation in the courts in an effort to break the Bell patents. But Bell always wins.

In 1884, Boston and New York are connected; in 1893 the line is extended to Chicago; in 1915 to San Francisco; in 1921 to Cuba. Today 17,000,000 telephones in the United States and 10,000,000 more in the rest of the world.

In 1922 Bell died, but he lived to see that first company grow into a nation-wide system that spans a continent.

The story of the telephone is a romance and a triumph of science. It is the story of trained men working together; of persistent effort, of able leadership, of loyalty to public service.

From the beginning there has been great advancement in the telephone art. The evidence is on every hand—improved switchboards, better cables, refinement in operating practice. Literally thousands of inventions have followed the telephone of 1876, each one making things a little better.

And now, the great Bell System with its 360,000 employees, more than 700,000 stockholders and nearly $3,000,000,000 of property investment. One policy, one system, universal service.

Fifty Years of Telephone Progress

A HALF century ago, on March 7, 1876, a patent was granted and issued to Alexander Graham Bell for a curious looking contrivance that developed into the modern telephone.

The apparatus resembled two small cones. It did not even have a name, for the patent was issued as "an improvement in telegraphy." Like the baby it was, the little instrument could only mumble its words. It could not then speak a single sentence.

But three days later, on March 10, in the top floor of a lodging house at 5 Exeter place, Boston, an improved apparatus did utter those memorable words: "Mr. Watson, come here; I want you," the first complete sentence ever transmitted over a telephone.

Fifty years have passed. Today the telephone is used by every civilized nation on earth. During the past ten years the development has been tremendous. And yet there seems to be no end to the stream of improvements that rushes on.

ALEXANDER GRAHAM BELL
Inventor of the Telephone

Grows with the Nation

In no other country has the telephone become so important in the daily life of the people as in the United States, which has today nearly 17,000,000 telephones, as compared to the 10,000,000 in Europe and all other countries. In the land of its birth the telephone serves a population of 112,000,000 who use it over 50,000,000 times a day. It has not only grown with the nation but it has helped to make the nation grow. It has helped to make the American people a homogeneous people. It has helped raise the standard of living and made a neighborhood of a continent.

Going back through the life of the telephone we come to the year 1876 which is pregnant with telephone history. Fifty years ago Alexander Graham Bell was busy with his experiments. The first sound, and even disconnected words, had been heard electrically over a wire by means of his first crude instruments. He had filed his patent at Washington and was patiently carrying on his experiments. But it was not until March of that year that the first connected sentence was heard by telephone. It was not until the same month that his patent was granted.

They were conducting an exposition in Philadelphia in 1876. It was a hundred years after the signing of the Declaration of Independence and the United States had become sufficiently united so that they were preparing to join in the celebration with other friendly nations.

The nation did not know that it had the telephone in embryo. It did not know that tucked away in an exposition building there was the germ of an art which would develop into the nerve system of the body politic. During that whole year the illustrated weeklies, like Harper's and Frank Leslie's, said not a word about the telephone.

"My God, It Speaks!"

At that time the country was on the eve of a great epoch of achievement. Not only was the telephone unknown, but there were no electric lights, no automobiles, no motion pictures, no typewriters, no electric cars, and naturally no aeroplanes, submarines, or wireless.

Looking backwards from today, it was the day of small things and the telephone started in a small way.

It is well known now, although not known then, that Professor Bell rather doubtfully exhibited his "speaking telephone" at the Centennial Exposi-

tion, where it attracted no attention until a group of distinguished visitors led by Emperor Dom Pedro of Brazil, who had known Bell in Boston as an instructor of the deaf, tried the new invention. "My God, it speaks!" exclaimed Dom Pedro. And Lord Kelvin of England, after a scientist's careful scrutiny, said it was the greatest thing he had seen in America.

MR. BELL IN 1876

Bell, with his assistant, Thomas A. Watson, and his farsighted backers Hubbard and Sanders, organized the nucleus of the Bell System, and began to improve, manufacture and install a few telephones, to be used between individual homes and offices. The idea of interconnecting the isolated groups soon followed and the first switchboard was a natural though, at that time, a very crude development.

Theodore N. Vail, persuaded to leave the United States railway mail service, cast his lot with the infant industry with results far beyond his own or anyone's expectations.

The founders of the Bell System had little money but they had great faith. They began a long and arduous struggle to establish a telephone service, and make it support itself, while developing and improving the telephone itself, interesting the public to use it and investors to provide means for its growth.

Always Growing

Every sort of an obstacle seemed to block their progress. Bell's patents were attacked, competition appeared, and technical difficulties which seemed insurmountable had to be met.

Nevertheless, there came a period of growth and expansion. By lectures and demonstrations the telephone was brought to public attention at home and abroad and a demand for instruments arose in many cities almost simultaneously, a demand greater than it was possible to supply immediately.

In spite of its constant struggle for existence, the telephone company bound itself to a policy of progress and improvement which has continued to this day and will continue in time to come.

Not satisfied to connect individuals in the same city, it determined to connect those of different cities, and the first long distance line was projected and finally made a success.

To insure apparatus which would work harmoniously and insure transmission, a manufacturing plant, now the Western Electric Company, was taken over and made a part of the growing Bell System.

The magneto switchboard was developed by scores of inventions to a high degree of efficiency and that was followed by the common battery switchboard which was even more efficient.

Invention followed invention in the type of the transmitter and receiver, and in the increasingly complex central office apparatus necessary as larger groups of subscribers desired intercommunication.

For carrying the wires, poles took the place of roof structures and as the multiplicity of wires grew beyond bounds, cables were introduced. The invention and development of cables from pipes carrying inefficiently a few wires to cables in large cities carrying as many as 2,400 wires, make a story of great romance.

BIRTHPLACE OF THE TELEPHONE
109 Court Street, Boston

Whence came all this invention, development and improvement? Starting with the attic room where Professor Bell experimented and Mr. Watson assisted him, the Bell Company was never without a laboratory. As the industry grew the laboratory grew with it, bringing together scientists, engineers and technicians in a never ceasing study to make the telephone service better.

Inventions and Research

In the Bell laboratories many inventions were made and the inventions themselves were there improved and made effective.

But the laboratories did more than that. They gave an opportunity for profound scientific research, so that fundamental principles were discovered for the enrichment of the scientific world.

As a result of this laboratory work the American Telephone and Telegraph Company, in 1915, made a demonstration of wireless talk from Arlington, Va., across the Atlantic to Paris and across the Pacific to Honolulu; and later New York talked to London. Another result was the loud speaker system which enabled a multitude of over a hundred thousand people to hear President Harding's inaugural address, and which, at the burial of the Unknown Soldier in the Arlington National Cemetery, gave to vast audiences in Washington, New York and San Francisco the entire ceremony by means of the long distance wires of the Bell System connecting loud speaker equipment.

More recently the Bell laboratories, as a result of their researches in the electrical handling of sound, have produced new aids for the hard of hearing, such as the deaf set, and the audiphone and the audiometer, as well as a new principle for the improvement of the phonograph. They have also produced a new device for talking motion pictures, and in conjunction with the development and research department of the American Company have developed the "telephotograph" method of sending pictures over wires.

Interesting as these byproducts are, they represent but a small part of the development and research work of the Bell System. Whereas forty or fifty years ago it was possible to talk by telephone for a few miles only, means have been found not only to talk across the continent, as in 1915 when the transcontinental line between New York and San Francisco was first opened, but to talk much greater distances, as from Catalina island in the Pacific to Cuba in the Atlantic, some 5,500 miles.

Circuit Capacity Greater

This extension of the talking radius by wires has been carried to such a point that Washington could talk to any of the principal capitals of the South American continent if the wires and proper equipment were installed.

Not only has the vacuum tube repeater made possible long distance talking on open wires, but it has also been applied to long distance cable with the result that conversation has been carried on through some 2,000 miles of cable where formerly one quarter of a mile was the limit of cable transmission.

There has also been a continuous advance in the circuit capacity; that is, in the use that can be made of a single pair of telephone wires. A fifty per cent increase in capacity was obtained by the so-called phantom circuit system by which three simultaneous conversations can be had over two circuits, and later more channels of talk over a pair of wires have been obtained by a multiplex system, which also makes it possible for a large number of telegraph messages to be sent simultaneously with telephone conversation.

The recently installed New York-Chicago cable is a fine example of what the headquarters staff of the Bell System is doing to improve telephone service and make it more economical. This cable, with its multiplexed wires, can carry as many messages as would be carried by ten pole lines, each heavily loaded with cross-arms and wires, and with almost complete assurance of freedom from damage caused by sleet and wind.

△ △ △

Bell Recalls Notable Day

In his address at the Boston City Club on March 13, 1916, Professor Bell referred to the memorable March 10, 1876, when the first words were spoken over the telephone, as follows:

"On March 10, 1876, clear and unmistakable speech was produced. It may have been done before, but on that date it was complete, and I myself heard speech reproduced perfectly by the telephone.

"I shall never forget the occasion. The message was this: 'Mr. Watson, come here; I want you.' And his immediate appearance in the room was a great gratification.

"Well, gentlemen, I tried that same experiment with a duplicate of the instrument used on that occasion, only a short time ago in New York, and Mr. Watson was at the other end of the line, in San Francisco. I was in New York.

"So I went up to the instrument and talked to Mr. Watson in San Francisco, and I said: 'Mr. Watson, come here; I want you.' But he didn't appear and he said: 'It would take me a week to get there now.' "

△ △ △

A Worthy Record

FOR forty years the Bell System, after providing for operating expenses, taxes, and interest has earned each year the total amount of the dividends paid and something for surplus—a margin for safety. Adequate provision has been made by charges to expenses for depreciation and obsolescence, thus providing for the cost of property which is being used up in giving service. The amounts obtained from this source, together with surplus earnings, have been invested in telephone property for the protection of the service.

Bell's Mishap Caused First Message

What did Alexander Graham Bell want when he uttered those historic words, "Mr. Watson, come here; I want you," on March 10, 1876—the first complete sentence ever transmitted over a wire electrically? TELEPHONE TOPICS prints the explanation for the first time in this issue. The story of what happened was written by Mr. Watson who is spending the winter in his Florida home.

Nearly every one knows that Thomas A. Watson was Professor Bell's first associate. He made the first telephone, assisted Bell in all of his experiments and was one of the four men who undertook the development of the telephone and put it on a business basis.

BY THOMAS A. WATSON

IT is almost impossible for me to say anything new about my early telephone experiences with Alexander Graham Bell, for, as a witness in the many law suits over Bell's patents, and for many publications and addresses, I have already dug out of my memory every recollection it contains of those stirring days.

However, here are some extracts from my yet unpublished autobiography which, even if they do not contain anything I haven't said before, may possibly reveal part of Bell's telephone struggles in a new light.

On June 3, 1875, I made for Bell, under his directions, the first electric speaking telephone the world ever had and on the evening of that day he and I talked through it for the first time on a wire that I ran for the purpose from the attic over Williams' workshop down two flights to my work bench. That was the beginning of the art of the electrical transmission of the spoken word that Bell's successors have since evolved into one of the greatest of all instrumentalities for the unification and harmonization of mankind.

THOMAS A. WATSON
Bell's First Telephone Associate

That first telephone was used for only a few weeks. As a result of the experimenting that followed, it was superseded by modifications that talked better and did not get out of order so easily. Bell continued for a while to work on his harmonic and autograph telegraphs from which, as they seemed to him nearly ready for practical use, he expected to get the money he needed for the perfection of his telephone. But his interest in the telegraph inventions soon died out and then he devoted himself to devising and testing improved forms of the telephone. In all of this work I took part both in constructing his apparatus and trying it with him.

Progress Naturally Slow

On account of this divided interest, as well as Bell's sickness at his father's house in Ontario, and the fact that he was obliged to spend much of his time preparing the specifications for his telephone patent, the telephone developed rather slowly during the nine months that followed the construction and testing of his famous first telephone. This slow progress of the telephone during these early months of its life was due not only to these interruptions but also because the invention was so absolutely novel that Bell's work on it was like cutting a path through a dense jungle at night.

Bell filed the application for his telephone patent on February 14, 1876, and his claims were so new and unprecedented that his patent was granted almost immediately, issuing on March 7, 1876. I well remember Bell's elation when he brought me the news that his telephone patent had been allowed almost as he had written it.

This patent, the specifications for which were written almost entirely by Professor Bell, is a monumental evidence not only of the clarity of

his marvellous conception of a speech-shaped electric current, but also of his comprehension of the only practical means for producing such a current. So fully and clearly did it cover the art of telephony that it has stood like a rock against the assaults of the host of claimants that sprang up as soon as the telephone became a tempting financial success.

When his experimenting on the speaking telephone had fairly begun Bell decided that, until his patent was secured, it was well to keep his apparatus more out of sight than was possible at Williams' shop. To do this he hired, for $4 a week, two rooms in the attic of a boarding house at No. 5 Exeter place, about half a mile from the shop. He slept in the room fronting on Exeter place, and the other room, looking out on Hayward place, I fitted up for him as a laboratory, running a wire to test the telephones on between the two rooms. After that was done practically all the experimenting for the next two years until the telephone was ready for public use, was carried on there.

MR. WATSON IN 1876

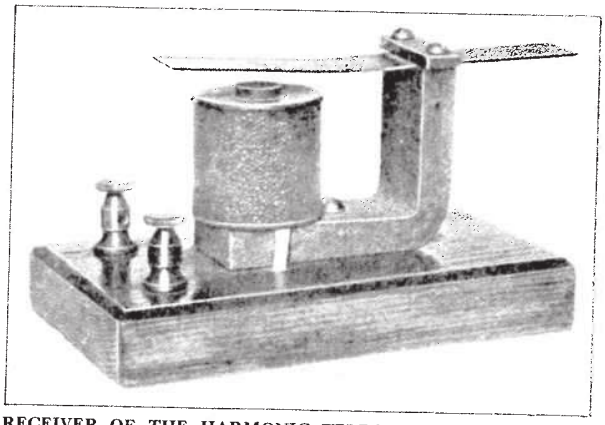
First Sentence Transmitted

Despite the many interruptions and the obstacles in the tangled jungle of technical difficulties that had to be struggled with, it was only nine months after the first telephone was made before it was sufficiently developed to transmit intelligibly a complete sentence. This was done by means of a variable resistance battery transmitter, one of the claims of Bell's telephone patent.

On March 10, 1876, I had finished for Bell a battery transmitter in which a wire, attached to a diaphragm, touched acidulated water contained in a small metal cup, both included in a circuit through a battery and the receiving telephone. The depth of the wire in the acid and consequently the resistance of the circuit varied as the voice made the diaphragm vibrate, making the galvanic current undulate in speech form.

I carried the transmitter that evening to the Exeter place laboratory intending to spend the night with Bell testing it. Neither of us knew that we were about to try the best transmitter that had yet been devised. We filled its cup with diluted sulphuric acid and connected it to the wire running between the two rooms.

When all was ready I happened to be in Bell's bedroom with my ear at the receiving telephone and



RECEIVER OF THE HARMONIC TELEGRAPH WHICH PROF. BELL WAS HOLDING TO HIS EAR WHEN HE MADE HIS FUNDAMENTAL DISCOVERY ON JUNE 2, 1875

was astonished to hear Bell's voice coming from it saying distinctly:

"Mr. Watson, come here; I want you!"

As he had no receiving telephone at his end of the line I couldn't answer him, but the tone of his voice indicating he needed help, I rushed into his room and found he had upset the acid of a battery over his clothes. He forgot his spoiled trousers when I told him how plainly I had heard his words and was jubilant when he went to the other room and heard how plainly my words came through.

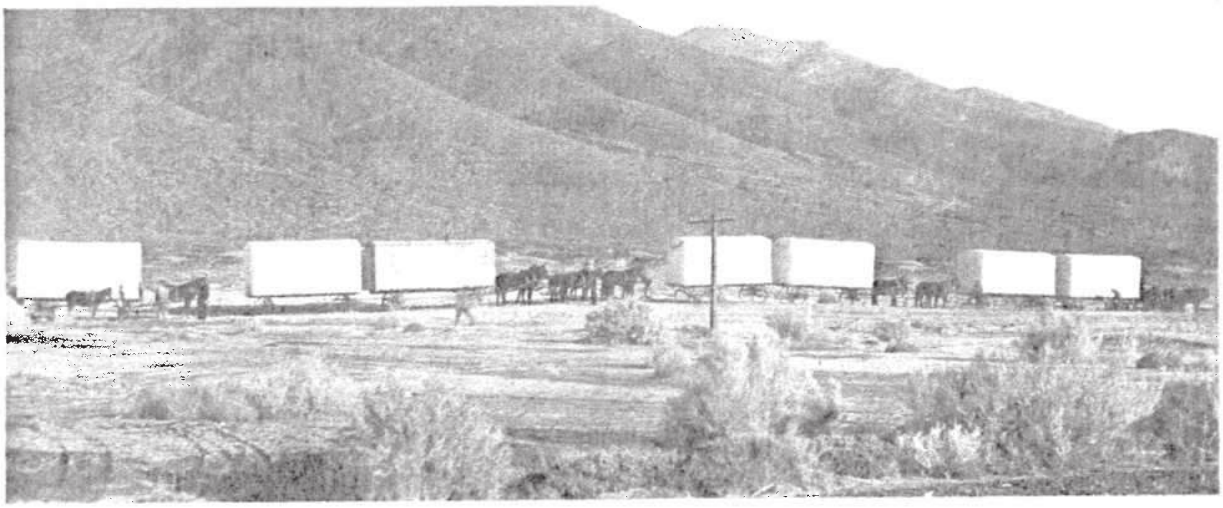
The transmission of this first sentence was so impressive that I noted it in my diary with some other phrases that were transmitted between the two rooms that evening, one of which was, "God save the Queen." My little book is now in the historical museum of the American Telephone and Telegraph Company in New York.

Bell Caught Unprepared

This important event in the history of the telephone would have been more impressive if Bell had transmitted a more poetic sentence. But not expecting such a sudden advance in the talking powers of his telephone that evening, he was caught unprepared. His shout for help on that evening of March 10, 1876, doesn't make as pretty a story as did the first sentence, "What hath God wrought!" sent by Morse over his telegraph from Washington to Baltimore some thirty years before, but I am quite satisfied with it and with the fact that I heard it.

The event is commemorated by a bronze tablet inserted in the wall of the commercial building on the corner of Exeter place and Harrison avenue extension, that now occupies the site of Bell's boarding house of 1875. It reads:

"Here Alexander Graham Bell transmitted to Thomas Augustus Watson the



HOW THEY TRAVELED TO BUILD THE TRANSCONTINENTAL LINE

Camp Number 2 coursing its way slowly westward with the cable that spanned the continent. This picture was taken in 1914.

first complete and intelligible sentence by telephone March 10th 1876. The Bostonian Society and the New England Telephone and Telegraph Company placed this tablet March 10th 1916."

That this advance in the talking power of the telephone came so soon after the date of Bell's telephone patent is a coincidence due to the fact that, as soon as he finished his work on his patent specifications, his experimenting was vigorously resumed and quickly brought results.

So, in the early evening of March 10, 1876,—fifty years ago,—one single sentence had been sent by telephone. I fancy a computation of the number of sentences sent daily through the seventeen million telephones now in use in the United States would give a figure quite astronomical in its vastness.

Passagrille, Florida.

△ △ △

Long Distance Strides

IN 1876 Bell succeeded in talking from Boston to Cambridge, a distance of two miles—the first long distance telephone conversation. Year by year the telephone reached out over greater and greater distances. Six outstanding achievements mark epochs in the history of long distance telephony. They are:

1880—Boston to Providence	45 miles
1884—Boston to New York	235 miles
1892—New York to Chicago	900 miles
1911—New York to Denver	2100 miles
1915—Boston to San Francisco	3650 miles
1921—Havana to Catalina	5500 miles

How Mr. Watson Hired Mr. Vail

FROM 1876 to 1878 the Bell Telephone Company, with its headquarters in Boston, had been engaged in a lawsuit with the Western Union Telegraph Company, and in the latter year the clouds gradually cleared away and the struggling company in Boston began to realize that it must have a business manager.

In his interesting story, "The Birth and Babyhood of the Telephone," Thomas A. Watson, Professor Bell's earliest associate, tells how he hired Theodore N. Vail, for many years the head of the Bell System.

Gardiner G. Hubbard, of Cambridge, who was one of the original backers of the telephone, told Mr. Watson he knew just the man they wanted,—"a thousand horse-power steam engine, wasting his abilities in the United States railway mail service."

Mr. Watson continues as follows: "He sent me down to Washington to investigate and report. I must have been impressed, for I telegraphed to Mr. Hubbard to hire the man if he could raise money enough to pay his salary. He did so. This was one of the best things I ever helped to do.

"When the new manager came to work, a short time later, he said to me: 'Watson, I want my desk alongside of yours for a few months until I learn the ropes.' But the balance of the conceit that previous two years had not knocked out of me vanished when, in about a fortnight, I found he knew all I had learned, and that at the end of a month I was toddling along in the rear, trying to catch up, which I never did."

△ △ △

No man ever retired on the money he spent.

Bell's Lectures Win Support

THE world was full of doubting Thomases even after Bell had demonstrated the telephone at the Centennial Exposition in Philadelphia; proved that the instrument would work out of doors and was practical for public business and social uses.

So much difficulty was experienced in convincing possible subscribers that it was finally arranged for Bell to deliver a series of ten public lectures throughout the East for the purpose of "selling" his devise. Incidentally the lectures solved Bell's pressing money difficulties. He received $100 for each lecture and demonstration.

It was appropriate that his first lecture was given in Salem where the inventor had spent so much time on preliminary work. He spoke before the Essex Institute in Lyceum Hall, on February 12, 1877. The first lecture was free to the society. It packed the hall and created such interest that Bell was requested to repeat it for an admission fee. The second lecture followed on February 23, before an audience that was described as large and highly enthusiastic.

First Profits Go to Girl

The inventor of the telephone spent the first profits from his invention in a manner which would not gain the approval of the sponsors of thrift. The second Salem lecture netted Bell $100. At that time Professor Bell had fallen in love with the daughter of Gardiner G. Hubbard, a Cambridge lawyer who was one of the early promoters of the telephone. Bell was so enraptured with his love affair, and so happy over the receipts of his second lecture, that he went to the jewelry store of Daniel Low in Salem and had a silver telephone made for the girl who later became his wife.

Noted Folk Hear Him

Immediately requests began pouring in upon Bell for lectures, the interest in the new invention being intense and widespread. Such men as Oliver Wendell Holmes and Henry W. Longfellow signed the request for the Boston lectures. Following another lecture in Salem, one was given in Providence to an audience of 2,000, three in the largest hall in Boston, three in Chickering Hall in New York and others in most of the large cities of New England. That all took place in the spring and early summer of 1877.

First came the commonplace parts of the entertainment, including descriptions and explanations, etc. Then came the thrillers—first Watson's voice shouting such sentences as "How do you do?" "Good evening," "What do you think of the telephone?" Watson made no pretense at being a musician, but his voice did carry well, and after proving that the telephone did really speak he would then sing such popular favorites as "Hold the Fort," "Yankee Doodle," "Pull for the Shore" and "Auld Lang Syne." Following the songs Bell would send further directions.

In addition to Watson's efforts, other entertaining features were provided. These would include electric howls of various pitches, a cornet player and sometimes a small brass band and electric organ. An audience in Providence was thrilled on hearing a band play "The Star Spangled Banner" in Boston, while on one occasion an exhortation from Moody and a song from Sankey came over the vibrating wire.

These public lectures served slowly to diminish the ridicule and the incredulity stirred up by the new invention.

Thomas A. Watson, in his "Birth and Babyhood of the Telephone," recounts incidents in regard to the lecturing days as follows:

"Bell's immediate financial needs were solved, however, by the demand that began at this time for lectures by him on the telephone. It is hard to realize today what an intense and widespread interest there was then in the telephone. I don't believe any new invention could stir the public today as the telephone did then, surfeited as we are now with the wonderful things that have been invented since.

"These lectures are important for another reason than that they solved a temporary money problem. They obviated the necessity of selling telephones outright, instead of leasing them so as to retain control—a policy Mr. Hubbard afterwards adopted which made possible the splendid universal service Mr. Vail, with your help, has given the Bell system today.

Invents Telephone Booth

"In making the preparations for the New York lectures I incidentally invented the sound-proof booth, but as Mr. Lockwood was not then associated with us, and for other reasons, I never patented it.

"It happened thus: Bell thought he would like to astonish the New Yorkers by having his lecture

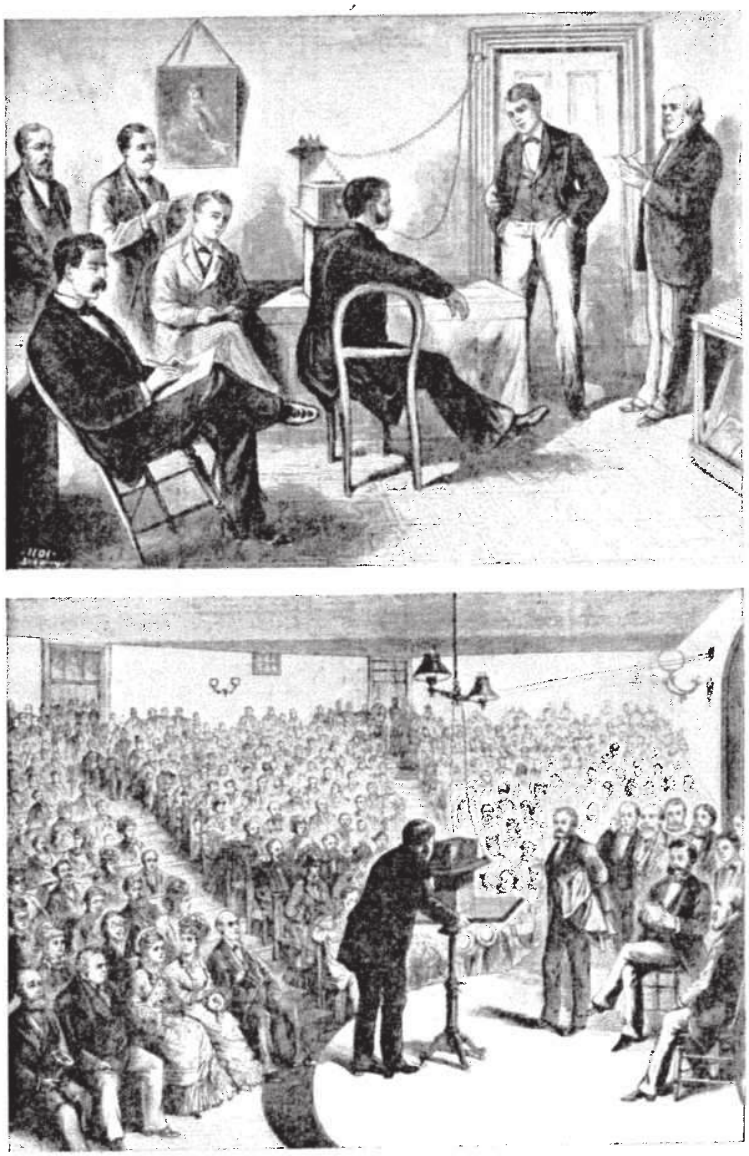
illustrations sent all the way from Boston. To determine whether this was practicable, he made arrangements to test the telephones a few days before on one of the Atlantic and Pacific Company's wires. The trial was to take place at midnight. Bell was at the New York end, I was in Boston laboratory. Having vividly in mind the strained relations already existing with our landlady, and realizing the carrying power of my voice when I really let it go, as I knew I should have to do that night, I cast about for some device to deaden the noise.

"Time was short and appliances scarce, so the best I could do was to take the blankets off our beds and arrange them in a sort of loose tunnel, with the telephone tied up in one end, the other end open for the operator to crawl into. Thus equipped I awaited the signal from New York announcing that Bell was ready. It came soon after midnight. Then I connected in the telephone, deposited myself in that cavity, and shouted and listened for two or three hours. It didn't work as well as it might.

"It is a wonder some of my remarks didn't burn holes in the blankets. We talked after a fashion, but Bell decided it wasn't safe to risk it with a New York audience. My sound-proof booth, however, was a complete success, as far as stopping the sound was concerned, for I found by cautious inquiry next day that nobody heard my row. Later inventors improved my booth, making it more comfortable for a pampered public, but not a bit more sound proof.

"I suppose I did have some fun during this time, but the only diversion that lingers in my mind is arranging telephones in a diver's helmet for the first time, and, finding that the diver could not hear when he was under water, going down myself to see what the matter was. I still feel the pathos of the moment, when, arrayed for the descent, just before I disappeared beneath the limpid waters of Boston harbor, my usually undemonstrative assistant put his arm around my inflated neck and kissed me on the glass plate.

"Before Mr. Bell went to England on his bridal trip, we agreed that as soon as the telephone became a matter of routine business, he and I would begin experimenting on flying machines, on which subject he was full of ideas at that early time. I never carried out this agreement. Bell did some notable work on airships later, but I turned my attention to designing plans for battleships."



FIRST PUBLIC EXHIBITION OF THE TELEPHONE IN SALEM

(Above) Thomas A. Watson talking from Boston and explaining the invention to reporters and scientists.

(Below) Prof. Bell in Lyceum Hall, Salem, exhibiting and demonstrating his new telephone.

(From Frank Leslie's Illustrated Newspaper, March 31, 1877)

△ △ △

There was an average of about 67,700,000 telephone calls a day in the United States in 1925. This would amount to 2,820,000 calls every hour if the traffic were evenly distributed over day and night.

Salem Cellar Scene of Tests

DEEPEST secrecy marked the early endeavors of Professor Bell as he worked in the cellar of the home of Thomas Sanders in Salem, at perfecting his telephone. Constantly Bell was afraid that his ideas might be stolen, as the world at that time was full of inventors working along much the same lines.

Sanders was Bell's principal backer in those early days, and it was in the Salem home that the inventor found the keenest interest and sympathy in his projects.

For three years the cellar was Bell's favorite retreat. He littered it with tuning forks, magnets, batteries, coils of wire and other accessories. Not a soul outside the Sanders family was allowed near the workshop. Bell's caution was such that he bought his supplies from several different stores for fear that his intentions might be suspected. He worked alone, usually at night, having little regard for the fact that sleep was quite as necessary for him as for the Sanders family.

SANDERS HOME IN SALEM, MASS.
Where Prof. Bell lived and carried on his early telephone experiments

"Often in the middle of the night Bell would wake me up," said Thomas Sanders; "his black eyes would be blazing with excitement. Leaving me to go down to the cellar, he would rush wildly to the barn and begin to send me signals along his experimental wires. If I noticed any improvement in his machine, he would be delighted. He would leap and whirl around in one of his 'war-dances' and then go contentedly to bed. But if the experiment was a failure, he would go back to his workbench and try some different plan."

△ △ △

Early Struggles in Poverty

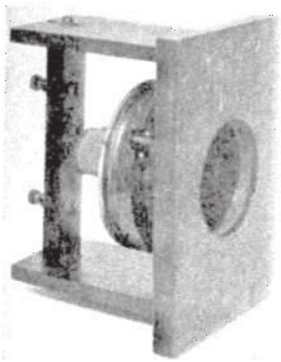
Thomas A. Watson told a number of stories about the early days of the telephone business about ten years ago. One of these stories follows:

"In 1877, when we first began to put telephones into public use, the available capital of the Bell Telephone Company was extremely small, and a large share of it had to be used in defending ourselves against the attacks of those who were trying to break the Bell patents; therefore, every dollar had to be husbanded and made to go as far as possible.

"None of us had a salary, and, aside from the expenses of the lawsuits we were forced to carry on, our principal need for money was to pay Williams' bills for constructing the telephones for us. As I was in charge of this, the earliest engineering department of the company, the responsibility for economy rested almost entirely on me, and not the least of my problems was to reduce the cost of the telephones without cutting down their efficiency.

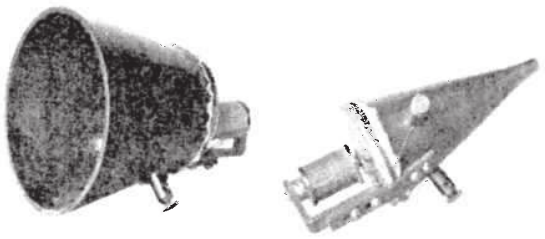
"Our standard instrument at that time was the big box telephone. They were not only clumsy to ship and install, but were also costly to build. One day, Williams presented for my approval a bill against us for constructing the largest lot of them he had yet turned out—twenty-five, I think, was the number. The total of his bill plunged me into despair, and ruin, it seemed to me, stared us in the face unless I could devise a telephone that would not cost so much. Although Williams' bill had taken away my appetite, knowing I should not get any dinner unless I was at my boarding house on time, I wended my way there at the usual hour, twelve o'clock, wondering how I could cut down the cost of that big box telephone.

"I don't remember what I had for dinner that day, but I have never forgotten the good idea that struck me while I was eating it. This happy thought was: to put the cores and coils on the side of the tele-



THE FIRST TELEPHONE—1875

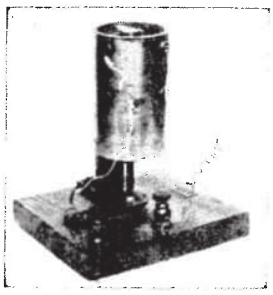
phone magnet instead of on its ends as I had been doing. This would bring the diaphragm parallel to the body of the magnet instead of at a right angle to it, and so allow a large reduction in the size of the box, and, consequently, a decrease in its cost. I fancy I risked indigestion by the speed

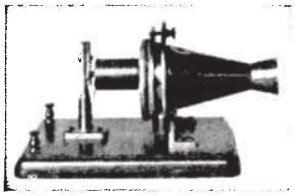


TELEPHONE PATENTED BY PROF. BELL IN 1876
The transmitter is shown on the left; the receiver on the right

with which I consumed the rest of my dinner, and rushed back to the shop to have a telephone made on the new plan.

"When, on testing it, I found it talked just as well as the big box telephone, I at once cancelled all previous orders for them and adopted the new flat telephone as our standard, thereby reducing all the big box telephones to the status of museum specimens, for which purpose they are still valuable.





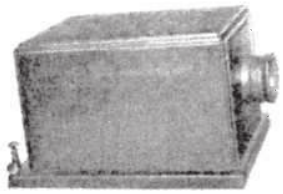
CENTENNIAL TELEPHONE OF 1876
Top, receiver
Bottom, transmitter

"The mouthpiece I used on these wall telephones is an illustration of the meagre facilities of the time, as well as the need for economy. I used a hard rubber sponge-holder from a medical shocking machine which Williams carried in stock. It answered the purpose perfectly, and saved us the expense and delay of making a special mould. This sponge-holder mouthpiece worked so well that its form was never changed as long as we used that type of telephone.

"I do not believe Mr. Carty was any prouder or gladder, when he got the transcontinental line working, than I was when I approved Williams' bill for the first lot of the new telephones that he made for us, and found that they cost less than half what the old style had, to say nothing of the fact that the cost of our packing cases was also cut in two."

First Outdoor Trial

Anecdotes of the early days of the telephone are valuable, they containing facts not related in ordinary reviews o the telephone's history. Among the most valuable is the assortment found in Thomas A. Watson's booklet "The Birth and Babyhood of the Telephone."

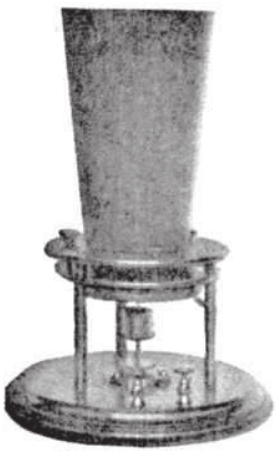


BOX TELEPHONE
Used on first commercial lines in 1877 for talking and listening

Some of these follow:

"On October 9, 1876, we were ready to take the baby outdoors for the first time. We got permission from the Walworth Manufacturing Company to use their private wire running from Boston to Cambridge about two miles long. I went to Cambridge that evening with one of our best telephones, and waited until Bell signaled from the Boston office on the Morse sounder. Then I cut out the sounder and connected in the telephone and listened. Not a murmur came through! Could it be that although the thing worked all right in the house it wouldn't work under practical line conditions?

"That fear passed through my mind as I worked over the instrument, adjusting it and tightening the wires in the binding posts, without improving matters in the least. Then the thought struck me that perhaps there was another Morse sounder in some other room. I traced the wires from the place they entered the building and sure enough I found a relay with a high resistance coil in the circuit. I cut it out with a piece of wire across the binding posts and rushed back to my telephone and listened. That was the trouble. Plainly as one could wish came Bell's 'Ahoy.' I ahoyed back, and the first long-distance telephone conversation began.

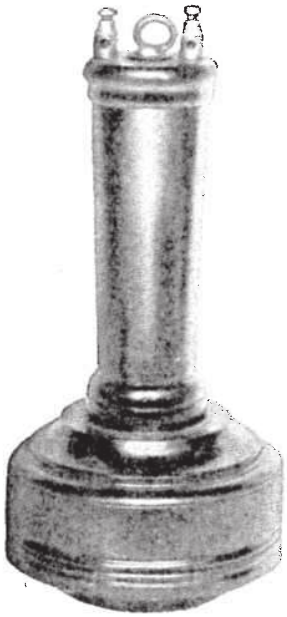


LIQUID TELEPHONE
Transmitter used by Prof. Bell on March 10, 1876 when he made the historic call: "Mr. Watson, come here; I want you."

"Skeptics had been objecting that the telephone could never compete with the telegraph as its messages would not be accurate. For this reason Bell had arranged that we should make a record of all we said and heard that night, if we succeeded in talking at all. We carried out this plan and the entire conversation was published in parallel columns in the next

morning's *Advertiser*, as the latest startling scientific achievement. Infatuated with the joy of talking over an actual telegraph wire, we kept up our conversation until midnight.

"It was a very happy boy that traveled back to Boston in the small hours with the telephone under his arm, done up in a newspaper. Bell had taken his record to the newspaper office and was not at the laboratory when I arrived there, but when he came in there ensued a jubilation that elicited next morning from our landlady, who wasn't at all scientific in her tastes, the remark that we'd have to vacate if we didn't make less noise, nights."



HAND TELEPHONE
Used commercially in 1877 both for talking and listening

"At about this time (April, 1877) Professor Bell's financial problems had begun to press hard for solution. We were very much disappointed because the president of the Western Union Telegraph Company had refused, somewhat contemptuously, Mr. Hubbard's offer to sell him all the Bell patents for the exorbitant sum of $100,000. It was an especially hard blow to me, for while the negotiations were pending I had had visions of a sumptuous office in the Western Union building in New York, which I was expecting to occupy as superintendent of the telephone department of the great telegraph company. However, we recovered even from that facer. Two years later the Western Union would gladly have bought those patents for $25,000,000.

"But before that happy time there were lots of troubles of all the old and of several new varieties to be surmounted. Professor Bell's particular trouble in the spring of 1877 arose from the fact that he had fallen in love with a most charming young lady. I had never been in love myself at that time, and that was my first opportunity of observing what a serious matter it can be, especially when the father isn't altogether enthusiastic."

△ △ △

Forecasting the Future in 1877

On September 15, 1877, when there were less than 1,500 telephones in all the world, and no central offices, *The Christian Register*, published in Boston, printed this prophecy:

"Our telephone works well in spite of wind or weather. It is always good-natured at the other end of the line. It never denies anything that it can readily grant. The foreman of the printing office finds a ready road to our ear; but the voice of the 'devil' we have never heard. There is a great prophecy in this new invention. We expect to be able some day to hear Brother Utter preach in Washington Territory, and Brother Dall in India, without leaving our desk."

Almost forty-six years later, on May 11, 1923, Joseph A. Bianco, a plant man, living at 17 Forest avenue, Medford, was running a loop from Revere street in the West End through an alley to a house on Beacon street. In a wall of that old house he found an old torn copy of *The Christian Register* containing the above interesting reference to one of the first telephones in Boston. It probably has never been printed until now.

The Beacon street house was the home of George H. Ellis, a printer at 101 Milk street, where he also served as the business agent of the Christian Register Association which published *The Christian Register*.

The telephone line connected the office and the home of Mr. Ellis and is included in a handwritten list of thirteen telephone users in Boston and vicinity issued by Stearns & George of 39 Pearl street on July 11, 1877.

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Underground Cables

AS all roads once led to Rome, so all the telephone circuits eventually reach the central office switchboard. In the large commercial centers all the telephone wires are now placed in underground cables. Previous to the development of underground transmission the pole lines in the larger cities carrying many cross-arms and circuits grew too cumbersome for the streets. A pole line on West street in New York City carrying the New England circuits had poles ninety feet high, each with thirty cross-arms, supporting three hundred circuits.

"MR. WATSON, COME HERE; I WANT YOU."

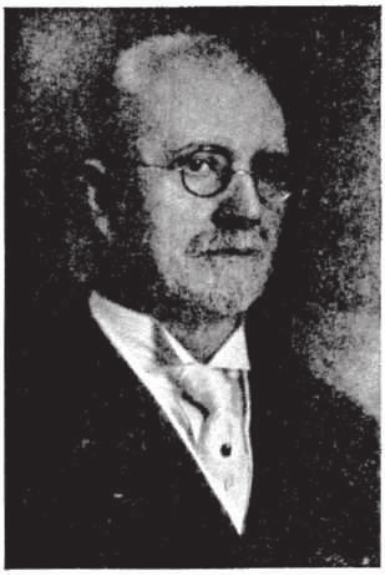
Stories by An Early Pioneer

Although he never went to school after eight years of age, Thomas D. Lockwood became the general patent attorney of the Bell System and held the position for nearly forty years. His training for that vitally important job came through hard work as a towboat hand in New York state, a paper maker in Massachusetts, a plate glass maker in Indiana, a school teacher in Arkansas, a telegrapher, freight clerk, locomotive fireman and engineer in Connecticut and New Jersey, and a reporter in Massachusetts. All of these activities gave him a broad insight into life. As soon as he started work for the National Bell Telephone Company in Boston in 1879, he began to acquire electrical knowledge. He is the author of scientific books and for many years was a power in the telephone world. As a contribution to this fiftieth anniversary edition of TELEPHONE TOPICS, Mr. Lockwood has written some interesting reminiscences.

BY THOMAS D. LOCKWOOD

NOT many of the first generation of telephone pioneers are left, at the close of the first half century, to tell the story of their own telephonic experiences and impressions. Thus, it certainly is in order to tell that story now; for, "How will it be when none more saith I saw?"

When, in July, 1879, I entered the service of the National Bell Telephone Company, that corporation, the immediate predecessor of the American Bell Telephone Company, had its general offices, comprising one large and three smaller rooms, at 95 Milk street, Boston. The large room was used for bookkeeping and accounting. The two smaller rooms at the rear were used by President William H. Forbes and Vice-President George L. Bradley, who was also treasurer. The third room, with a desk in each corner, was occupied by Theodore N. Vail, general manager; O. E. Madden, whose title was superintendent of agencies; Thomas A. Watson, general inspector, and myself. There was also a desk for the stenographer.



THOMAS D. LOCKWOOD

How Vail Hired Him

When I went to see Mr. Vail to get a job I expected to undergo some sort of medical examination, or something of that sort, and some sort of questioning that would give an idea of my electrical and other attainments. But he said, "Mr. Lockwood, I am very busy. I wish you would go back to New York now"—I suppose he had looked at me—"and let me know what is the lowest price you will come for." I did just that, which is doubtless what would have occurred to many others to do. Since I was told to name what I thought was the right amount, I placed it, as I thought, fabulously high, and was surprised to find that it wasn't taken as such when I got the return letter.

We had much correspondence; all, however, in long hand, there being no typewriters; and all of us were supposed to turn our hands to any kind of work that might be required. In the counting room were Robert W. Devonshire, chief clerk, now vice-president of the American Telephone and Telegraph Company; T. B. Bailey, later purchasing agent; and G. D. Milne, subsequently treasurer of the American Telephone and Telegraph Company.

I was the first electrical engineer engaged, and for a while bore the title of assistant general inspector. During those early days I opened a number of telephone exchanges in the New England states, New York and New Jersey; and visited many others to help them out of their technical difficulties.

We used to receive very many singular letters at that time. One writer was very anxious to find out whether, if he organized a telephone exchange, he would be able to get a proper amount of hollow wire, the amount that would be required.

Another one, from Bradford, Pa., wrote and said he was putting up a line that expected to take in two or three places— going from Bradford to Richburg and Olean, or some other places nearby, and that he had got one wire up, but that there were noises of all kinds, frizzling and frying noises, so that people did not know what was being said, and he wanted to know what he could do about it.

We wrote to him that the only remedy was a metallic circuit. Unfortunately we did not go into the particulars of a metallic circuit. So he solved the problem in his own way. He thought he might as well run the line around in another way and take in four or five other towns, which he did, and then wrote us that our remedy had made things

much worse than they had ever been before.

We had a fad at that time, which has been reproduced a number of times since, of putting in selective bells, or what we called individual bells on the circuit. I think we tried perhaps one hundred and twenty-seven different kinds from beginning to end. We had an electrical engineer named Anders, who was always devising some good mechanical thing—poor electrically.

THEODORE N. VAIL

"Master of the wires," directing genius of the world's telephone business for 24 years until his death in 1920. Left, Mr. Vail in 1878. Right, portrait taken the year he died.

New Source Lost

In Cambridge at that time there were seventy or eighty subscribers. When any one of them was wanted, at the central office an induction coil was put in operation, a big one, and a push button sent out rapid vibrations along the line, and the number of the party would be boomed out on the receiving telephone.

If you wanted 321 it would go 00, 00, 00—00, 00—00. We introduced the individual signals there and they were welcomed as a very great boon, except at one house, where three spinster ladies lived. They objected to any change from the old system. They said, "This is the only newspaper we have. When anybody is called on our line we always listen to what is said, and we get lots of news."

At that time there was but one lawsuit in progress. This was one brought by the Bell Telephone Company (one of the constituents of the National Bell) against one Peter A. Dowd, a Western Union Telegraph Company agent. It was known through all the subsequent litigation as the "Dowd" case. It came to end in November, 1879, and the Western Union, acknowledging the validity of Bell's patents, withdrew from the contest and the telephone business. Shortly after this settlement the Bell company rented the *entire* fifth floor at 95 Milk street, and there we stayed until 1890, when we moved into the new building at 125 Milk street.

Every one knows that the fundamental Bell patent, 174,465, was issued March 7, 1876, on an application filed in the patent office on February 14, 1876. But it is not so well known that, when the application was filed, there occurred a remarkable coincidence. This was that another inventor, Elisha Gray, *on the same day*, filed in the patent office a caveat also relating to the electrical transmission of speech.

Now a caveat was a statement that a person filing it had thought of an invention, but had not completed it or worked it out, and was filing the caveat to establish an official record of his date of conception. By the law at that time a caveat was good for the period of one year.

Should an application for a patent for the same invention as that described in the caveat be filed at any time *within* the year during which the caveat was in force, the caveator would be notified to complete his invention and file his patent application, while the application already filed would be suspended for ninety days to give time for such completion by the person who had filed the original application.

Patent Allowed and Issued

Accordingly, Bell was thus suspended in view of the caveat, but, upon it being ascertained that his application was filed earlier in the day than the caveat, the commissioner of patents ruled that the said caveat could not be regarded as *pending*, or *in force* when the application was filed, and the requirement of suspension was withdrawn. Then, after a slight amendment in form was made the patent was promptly allowed and issued.

It is of some interest to inquire what would have happened if the notice of this caveat *had not been withdrawn*. The answer to this question is: *Delay* in the grant of the patent, and delay only. For it is to be kept in mind that the telephone was at that time quite unknown and without any public interest; and that it was not until it proved itself valuable that there was any large crop of inventors alleging priority or independent invention.

Supposing the caveator *had been permitted* the ninety days to complete his invention and had himself filed an application, there would then have been declared an interference proceeding to determine priority of invention. Now, as a matter of fact, Gray did later, when backed by the Western Union, file an application, the interference was declared, and a number of inventors (Edison among them) became involved, but the issues were all decided in favor of Bell.

In the several hearings before successive patent office tribunals, the Western Union telephone interests, having become Bell interests also, were

to some extent looked after by Bell lawyers. In final hearing of the interferences the late Senator Roscoe Conkling was counsel for Edison, and as by that time the Western Union people had largely forgotten all they had ever learned about the telephone, it devolved upon me to coach Mr. Conkling; and I frequently had to caution him by pulling his coat-tail, when he verged on inaccurate statement. He remarked that he felt as if he were indeed "between the devil and the deep sea."

Sleet Storm of 1880-1881

In those early years sleet storms were ever a potential terror, for there was no underground construction and but few aerial cables. On the roof of the central station there was a terminal house, termed a cupola, surrounded by a roof structure, to which all the line wires coming from every direction were attached. A real blizzard or a sleet storm invariably produced disaster and destruction.

In the winter of 1880-1881, we had one—such a one as some of us old telegraph men had been dreading. The Boston central station had recently been moved to 40 Pearl street, and we had a good view of its roof from the rear fifth floor windows of 95 Milk street. I vividly remember watching with great anxiety the rapidly increasing size and weight of the last few stretches of the thousand or more lines terminating in the central roof structure.

If the roof and its fixtures held, nearly all the lines would give way and go down; while, if the lines held, they would tend by their united leverage to displace the roof and everything upon it. Many of the lines *did* give way, fortunately not all at once, but in small groups.

President Forbes was much disturbed. He came to me and asked if something could be done to prevent a disaster. I had to tell him, nothing until the storm ceased. He had formed a sort of hazy idea that we might be able to get some of the arc light companies (there were at that time three or four in Boston) to supply us with current strong enough to heat our line wires and thus melt away the sleet and ice thickly coating them. I had to show him the impracticability of this idea.

But as the evening drew on I found it expedient to visit the head offices of the arc light companies to persuade them to refrain from using lighting current that night, for we feared that serious fires might ensue from the inevitable crosses between the wires of the two systems. They were all very good about it and readily agreed that they would not light up that night.

I have frequently been asked, when and how it was that I, who had entered the telephone service to be an engineer, developed presently into a patent expert concerned mainly with inventions, patents, patent practice and patent litigation, ultimately becoming general patent attorney. Looking back over the past fifty years I can now see that, under the circumstances, this transition was most natural and almost unavoidable.

Life of Varied Experience

Compelled to leave school at the age of eight, and being at regular work when eleven, it was fortunate for me that I had innately a great love for instructive reading, and for amassing information on all possible subjects; besides possessing, as Casson in his "History of the Telephone" has said, "a memory like a filing system."

My work at that time, in England, was in a machine shop, and I was a fairly good machinist by 1865, when my father's family emigrated to Canada.

That same year, I learned to be a telegraph operator. But, alas, in those days competitive telegraph companies were built to sell, and generally sold out after a brief life. That was what my employer did; and as I could not afford to await the coming of another one I determined to take any work I could get and to change into other employment whenever such change promised advantage.

Thus it was that coming into the United States I successively engaged in making paper in Massachusetts, making plate glass in Indiana, and teaching school in Arkansas.

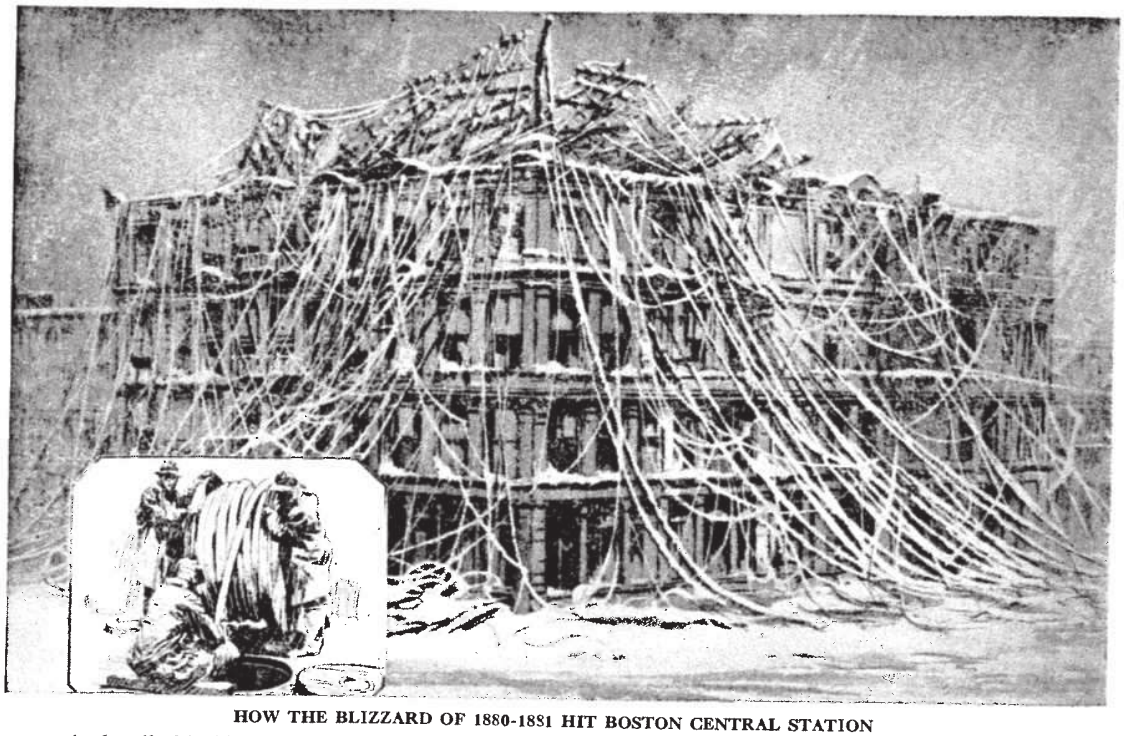
Working east again, in 1871, I tried railroad life in Connecticut and New Jersey—serving in the course of three years as telegrapher, ticket clerk, freight clerk, chief clerk and paymaster in the master-mechanic's department, signal operator and fireman and engineer on trains. Reaching New York in 1875, I first became inspector in a private fire alarm service, and later occupied, in rapid succession, positions in the Gold and Stock, and American District Telegraph companies. I was constantly improving my knowledge of the principles and practice of telegraphy and acquiring valuable experience in handling circuits and apparatus.

In 1878 I began to study and experiment with telephones, and to work with those introduced by the Western Union Company in competition with those of the Bell Company. But, as stated above, I joined the Bell forces in 1879 and in that service all my later life was spent, until retirement in 1919.

Forms Patent Bureau

Mr. Vail, when first I knew him, was fond of inventions and inventing. Quite early in my association with him I had the luck to see the weak spots in an invention in which he was interested, and prove that it would be a failure.

Thus it came about that in 1881 he became



HOW THE BLIZZARD OF 1880-1881 HIT BOSTON CENTRAL STATION

As described in Mr. Lockwood's story thousands of lines terminated in this roof at 40 Pearl street, and the coat of ice cast terror into the hearts of telephone men. The inset shows the contrast, underground cables which have no fear of ice.

impressed with the belief that the American Bell Telephone Company should collect and make available all of the knowledge on telephonic subjects that existed, and what new facts developed. When, also, the patent counsel of the company wanted some one to make and supply them with ammunition in the form of such knowledge, his mind turned to me. It was then that he instructed me to organize and take charge of a bureau of patents and technical information. Though I knew nothing of patent practice, or patent law, then, I set myself assiduously to learn all I could about both, gradually growing to manage things with pretty good success.

The duties of the new department were manifold and steadily increased. They comprised the consideration and evaluation of submitted patented and other inventions; the determination of their desirability, and keeping track of and indexing all domestic and foreign electrical patents as they issued. I conducted this work first as engineer in charge of, and later manager of, the Patent department, becoming general patent attorney in 1911, and consulting patent attorney in 1918.

Draws Up Vail Patent

But our own people, even including Mr. Vail, were continually making inventions. Although previous to that time outside solicitors of patents had been employed to take charge of their applications, I found it expedient that this work also should be done, so to speak, at home.

The first patent I myself ever drew up was for an invention of Mr. Vail's, in selective signals for party lines. I keenly recollect, to this day, the trepidation and alarm I experienced when he told me that he did not want any outside attorney and that he desired and expected me to draw up his case and prosecute it before the patent office. But I pulled myself together, wrote the specification which was long and difficult, and, rather to my surprise, made a success of it, obtaining a good patent.

While thus mainly engaged as departmental head, I found that I could also make myself of use in many more personal activities, such as legislative inquiries, and assisting counsel of the parent and associate companies in all of their several litigations, which were many. In all of these ways I continued to gain much valuable experience and, to quote from Dr. Thomas A. Watson's "Birth and Babyhood of the Telephone," the patent lawyers kept me thus at work until I "practically captured their job."

Here is an odd story about Mr. Watson, who, everybody knows, was Professor Bell's first associate and who made the first telephone. He happened to be in England for the first time during

one of the lawsuits over the Bell patents. In the suit Mr. Watson was asked his name. He said, "Thomas A. Watson"; but I suppose the early training of the clerk of the court was too much for him, and he took it down "Thomas Hay Watson," and that is the way it appears in the *Electrical Review* of London and in many of the English electrical records.

Opened Early Exchanges

I don't know where the telephone business would have been today if it hadn't been for the scientific use of the imagination. I came into it early and I opened the exchanges at Manchester, N. H., Stamford, Conn., Norwalk, Conn., Taunton, Mass., and several others. I hadn't the slightest idea of taking up the line which was ultimately thrust upon me; namely, that of looking after the interests of the inventions and patents of the company. I didn't have anything like the scientific imagination that Mr. Carty had. I could see that there was something coming, but I didn't have quite the courage to look forward and see what it might be.

I was present at the opening of the Lowell line. I was sent to Lowell to open that end of it. There were two iron wires, and for iron wires they worked very well. But they had one very unfortunate proclivity. You could send a message on either one of them from either end and it could be heard on the other end. So, perforce, whether we liked it or not, we had to make a metallic circuit out of it and to make that fit in with the single wire iron line for the subscribers at the Boston and Lowell ends. We had, whether we liked it or not, to invent the repeating coil, and I believe that the repeating coils used on that line when we had to turn it into a metallic circuit, very much against our will, were the first repeating coils ever used. I think I have one of them yet.

Stock Hawking Story Denied

Many persons have so many times heard and repeated the legends of how Professor Bell hawked telephone stock about in payment for bills in 1876 and 1877, and offered it at preposterously and ridiculously low prices, that they have become accustomed to them, and have really brought themselves to believe not only that such things happened, but that they happened within their own personal knowledge, and indeed that they themselves were the recipients of such offers.

But Mr. Bell could not have attempted to liquidate bills by stock at that time, for no such thing as telephone stock was in existence. The general idea seems to be that even at such an early period in the history of the telephone there was a Bell Telephone Company, and that its stock at that time was practically valueless, and was being peddled about freely at a few cents per share.

The facts are, that no telephone company was organized by the owners of the patents until February 12, 1878, when the first company, viz., "New England Telephone Company," was formed with a capital of two hundred thousand dollars, to exploit the telephone in the New England States. Clearly no one could have offered shares for sale in 1876 that did not exist until 1878. No stock of any of the earlier companies was ever sold at a price less than thirty dollars per share.

Before the organization of the first, or New England Telephone Company, there was not any capital stock of any kind, but the telephone patents were vested in Mr. Gardiner G. Hubbard, trustee; the principal owners or participants in this trusteeship being Messrs. Hubbard and Sanders, and Mrs. A. G. Bell, Mr. Bell having transferred the majority of his interest therein to his wife.

Mark Twain's Telephone

I knew Mark Twain. I knew him for a great many years, and he was relatively a young man when I knew him first. When I went into the telephone business—I think I had been in the business about two years—he wrote me a letter which I still have, and it read like this:

"I see that you have written a book, and I bought the book, and I enjoyed it and was much entertained; but after reading it through from A to izzard, I find that I know very little more about the telephone than I did at first.

"I have read it, in fact, with the same sort of inscrutable enjoyment with which I should read a book written in Sanscrit, knowing that there was something good there if I could only get at it. But it gave me no light upon my own special telephone problem, which is this: I want to know why the inspector of the Southern New England Telephone Company feels it a necessity to examine my telephone every day of the three hundred and sixty-five in the year.

"I have formed a sort of nebular hypothesis upon it, and it is this: When my telephone was first installed, the same inspector, aided by two or three linemen, came and set it up, and I felt it my duty to set up the cake and wine, and having begun that way I felt it my duty to keep on.

"I have now had a telephone for exactly nineteen months, and the number of bottles of sherry that I have had to use up on that inspector, and the number of cakes my cook has had to bake—well, it reaches pretty well up into infinitude."

I explained to him later that that was not really one of the necessaries of telephone service, but he wrote me back that he didn't see his way clear to stopping it, having begun and having carried it along such a long time. And then he sent me a presentation

copy of a book which he had then just published, entitled "Life on the Mississippi."

I was in jail once in Manchester, N. H.,—it was the day I opened the exchange, Thanksgiving Day, 1879,—and to get in there to put in the subscriber's instruments, we had to be locked in, and I was locked in. In life we needn't be prisoners very long, because no matter how humble, how weak, how ineffective the vocation of any of us is, or the work of any of us is, my experience is that it is bound to be taken notice of by somebody. It doesn't always mean a raise of salary when it is taken notice of—not right away, but when we get an advance, we have opened the way for another advance; and when we get that, for another advance; and by and by there comes a time when the employee becomes at least as valuable to the employer as the employer is to him, and then he is a made man.

I think that the way for any young man in any business—most of all in the telephone business—to make himself a success, is to be possessed with the conviction that he is a success, and if he is not, he is going to be. If he is sure he is not, he certainly won't be; if he thinks he is not, it is not very likely he will be; if he is sure he is, he is about certain to be, provided he is not averse to putting his nose to the grindstone.

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The First Rate Case

FIXING the rates for telephone service in 1877 was guesswork. There was nothing to go by. The many refinements of telephone accounting were unknown then.

When E. T. Holmes was operating his express calling system (not a central office for intercommunicating) in the fall of that year at 342 Washington street, Boston, the question came up for serious consideration. In his book, "A Wonderful Fifty Years," he tells how the problem was solved.

"Mr. Hubbard [Gardiner G. Hubbard, one of Bell's original supporters] came into my office one day and sitting down at the other side of my table desk, said, 'Well, Holmes, what are you going to charge for the express service?'

" 'About five dollars a month,' I replied, whereupon he held up both hands and exclaimed:

" 'Now, Mr. Holmes, this telephone is going into every store in the land and we must make it cheap.' Mr. Hubbard was always very enthusiastic and had wilder ideas than any one else.

" 'Cheap,' I said, 'why, what would you charge?'

"After thinking for a moment, he said, 'A dollar a month.'

" 'What, twelve dollars a year?' I replied, 'and ten of it to you for the 'phone, and two for me to build and run the business on?'

"And the old gentleman laughed and said: 'Well, I guess I am as far off as you are.'

"After some further talk it was decided to charge three dollars a month, but before a year was out we were obliged to raise the rate to my first figure of five dollars."

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Doolittle, Pioneer Wire Genius

ONE of the pioneers of the telephone business, whose name will always occupy a place in telephone history, is Thomas B. Doolittle. He was the pioneer engineer of the telephone business and the inventor of hard-drawn copper wire and its application to telephone uses.

THOMAS B. DOOLITTLE

One of Mr. Doolittle's earliest achievements, and the one with which his name is most generally identified in telephone circles, was the invention of the hard-drawn copper wire and its application to telephone uses. The conductivity of copper was well known and recognized in the electrical world, but the great objection to it was that it would not sustain its own weight, as Professor Morse ascertained to his sorrow when he tried to run a copper circuit from Baltimore to Washington.

Nor would it work well when wound with iron wire to support it, because of the chemical action that was set up.

Mr. Doolittle conceived the idea of hardening the copper by a process of drawing and made a successful demonstration of this principle as early as 1877, in connection with a telephone system employed by the Ansonia Brass & Copper Company.

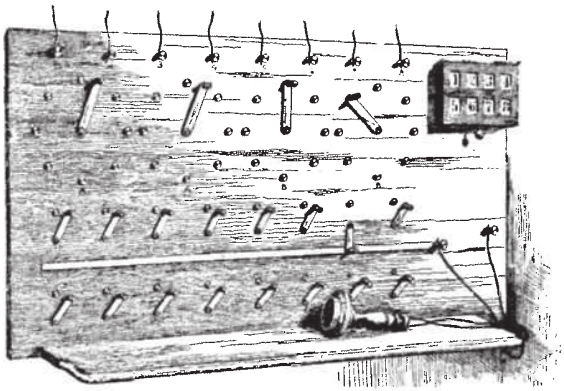
The engineering world was slow to endorse it, however, and it was not until Mr. Vail directed Mr. Doolittle to construct a circuit of ha[illegible] copper wire for long-distance telepho[illegible] between New York and Boston that t[illegible] were convinced.

△ △ △

IN making and planning additions to plant the many advances in the telephone art have been so adapted to equipment already in use as greatly to increase capacity and improve service without necessitating any extensive scrapping of existing plant. The development of improved cable transmission and of central office apparatus are marked examples.

Primitive Early Exchanges

AT first there were two telephones at either end of a wire. The first telephones introduced commercially were leased in pairs and the lessee in many cases strung his own wire to connect the two telephones, as for example, from home to office. There was no possibility of an interconnecting telephone system until the advent of the central office switchboard, the nerve center of the exchange system.



FIRST TELEPHONE SWITCHBOARD IN NEW HAVEN FOR EIGHT SUBSCRIBERS

The first switchboard to connect telephone circuits was installed in Boston, in May, 1877, and connected five banking houses. This simple exchange system served as a telephone system by day and a burglar alarm system at night. In January, 1878, the first commercial telephone exchange was established at New Haven, Conn., with eight connected telephones, and soon after switchboards were installed at Bridgeport, New York and Philadelphia. Various forms of switchboards were developed, succeeding each other in rapid succession. At Chicago, in 1879, the first multiple switchboard was installed. In 1896, the Battery System was first installed.

The "multiple" switchboard is so-called because each subscriber's line that terminates at the switchboard is duplicated or "multipled" on every section of the board. By this arrangement each switchboard operator, in answer to a call from any of the subscribers whose lines are assigned to her, can connect that subscriber's line with any one of the other lines that terminate at the switchboard.

The largest type multiple switchboards have more than 2,000,000 tiny, soldered parts, 15,000 electric signal lights and more than 4,000 miles of wire, more than enough to span the continent. A year is needed to build, and another year to install, each one.

The automatic switchboard or machine-switching system is now being introduced in places where conditions make it desirable.

There are nearly 6,000 central offices in the Bell System, serving exchange areas and linked together into one system of intercommunication by exchange, trunk, toll and long-distance lines aggregating 27,000,000 miles of wire.

Bell System telephone subscribers are invited to visit and inspect any central office at any time.

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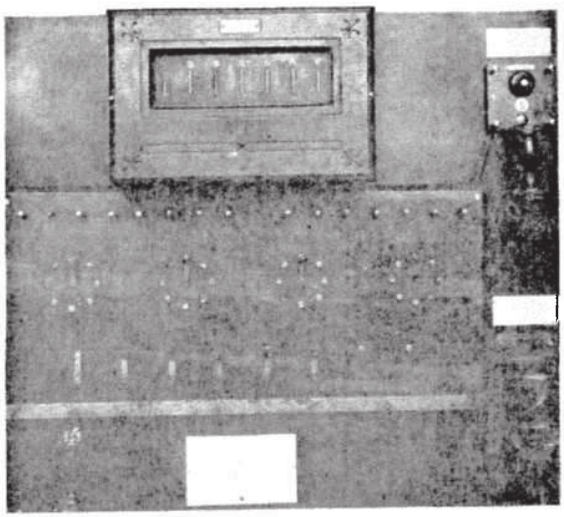
First Board in Lexington

THE first common battery switchboard in the world used for exchange service was installed in the Hump Building, Lexington, in the latter part of 1893.

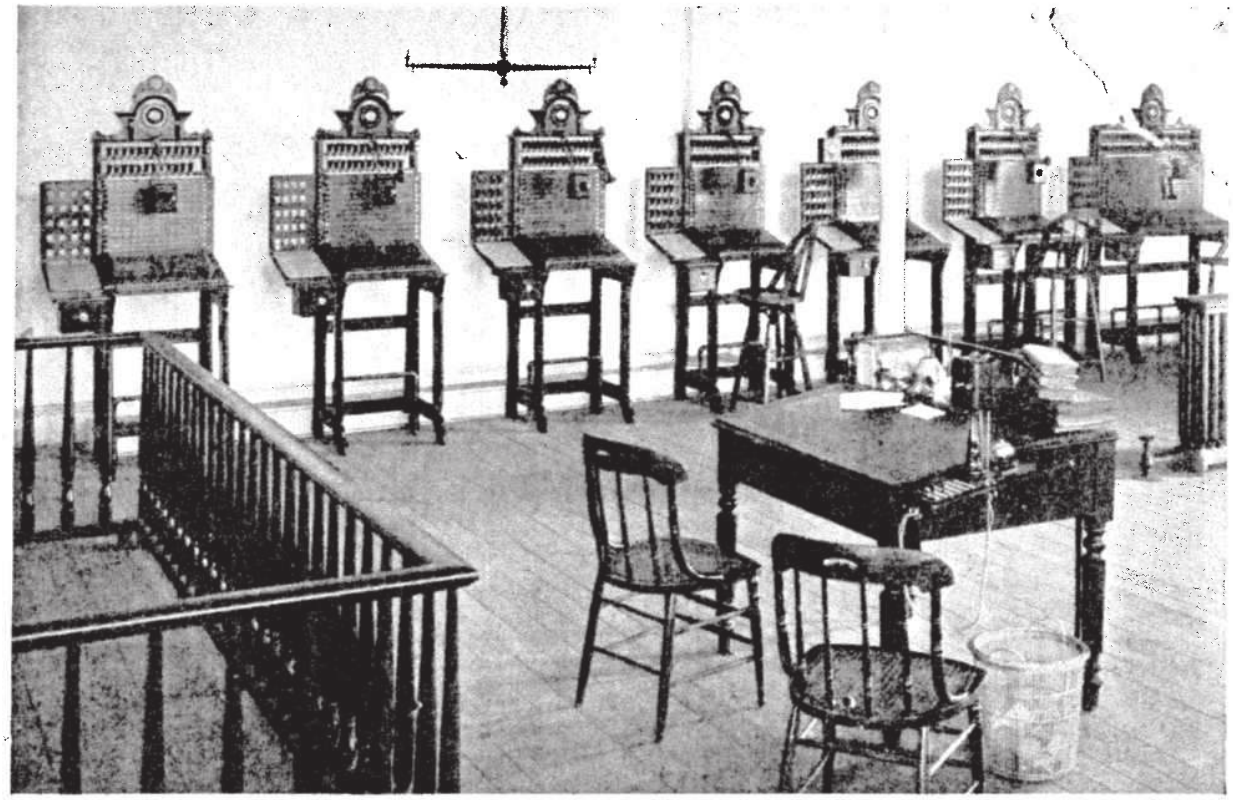
The new switchboard was installed by John F. Hyland, one of the oldest employees of the company. The exchange force at that time consisted of Harry W. Packard, manager, and Miss Florence Hardy, operator.

The Lexington exchange was opened with one subscriber, Leonard G. Babcock, at that time the postmaster at Lexington. Previous to the opening of the central office there was a pay station in Lexington connected with the Arlington office.

The exchange was operated by storage batteries, the dynamo used for charging being located in a grain mill, in the rear of the office and owned by



THE SECOND COMMERCIAL SWITCHBOARD BUILT IN MERIDEN, CONN., IN 1878



PORTLAND, ME., SWITCHBOARD IN 1883

Bradley C. Whitcher. The charging of the batteries was rather irregular, power only being furnished when the mill was operated for grinding or unloading grain from cars.

The growth of the exchange was very slow, for in October, 1885, there were but forty-two subscribers.

In December, 1903, the Lincoln central office was put into service with about thirty-five stations which were removed from the Lexington office.

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Main Moving Day in 1891

ON July 11, 1891, the Main central office in Boston, including the local and toll switchboards, was removed from 50 Pearl street to 125 Milk street.

The cut-over was entirely unlike the process now used in transferring the service from one switchboard to another, and is still remembered by some of the old-timers in the company.

A bridge was built across Pearl street and the okenite cable run along the bridge across Pearl street over roof tops, up the rear of the 125 Milk street building and down the cable shaft. The work caused a great deal of comment at that time by Boston newspapers, and several of them printed special stories with photographs of what was considered an enormous job.

Job Marks New Era

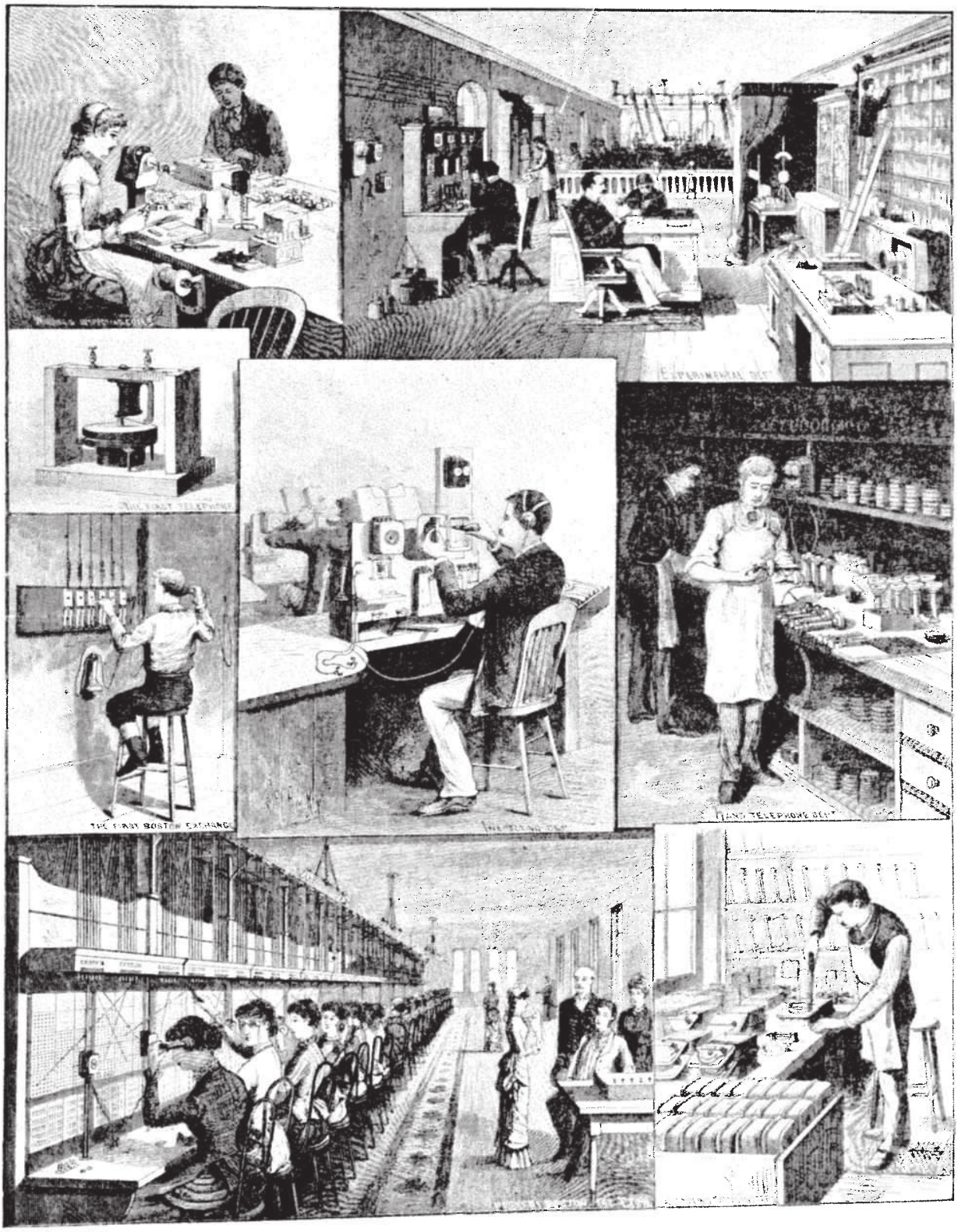
The bridge was considered a marvel of engineering construction. It was supported by steel stays and the cable was pulled along it from the cable shaft of the Pearl street office to the cable shaft at Milk street.

A wooden staging was built up the rear of the 125 Milk street building to enable the men to pull the cable to the roof. Step by step it went up, and the gang at intervals on the ladder pulling the cable. It was a gigantic job. Although there was no change in the type of switchboard, the cut-over being from magneto to magneto, the job marked a new era in our business.

In 1901, a common battery system was installed in Main.

△ △ △

Telephone subscribers can obtain first-hand knowledge of the many activities carried on in a central office by seeing one in operation. Such a visit may be arranged for at any Bell System business office.



TELEPHONE ACTIVITIES AS PORTRAYED IN THE "SCIENTIFIC AMERICAN" OF 1884.
THE ABOVE PICTURE WAS REPRODUCED FROM THE COLLECTION OF PERRY WALTON.

Brazilian Emperor Aids Bell

BUT for the solicitude of Dom Pedro, emperor of Brazil, the history of the telephone, and to no small degree the history of the United States, might have been far different.

As in all countries and in all times, there were deaf children in Brazil in 1876. Dom Pedro's interest in them led him while visiting North America to consult a young Boston teacher of the deaf, Alexander Graham Bell, who was using a method of teaching the deaf with great success. After his trip to Boston the emperor eventually went to Philadelphia where he was a guest of honor at the Centennial Exposition.

DOM PEDRO

Emperor Recognizes Bell

It chanced that he and his official party were making a private inspection of the Centennial exhibits on the only day on which Bell was in attendance at the exposition, having gone there in order that he might demonstrate an exhibit to the official judges who were that day to inspect electrical and scientific devices for the purpose of making the Centennial awards.

It was a hot June day. These men of science—who included Sir William Thomson, foremost English scientist of his day, and Joseph Henry, almost if not quite his peer in America—were worn out after their long and trying tour of inspection. They were about to adjourn for the day, leaving the remaining exhibits—Bell's among them—for attention at some later date.

Just at this juncture Dom Pedro recognized in the party the young teacher of the deaf whom he had met in Boston.

"Why, Mr. Bell, what are you doing here?" was his friendly greeting. Bell explained that he had perfected a device, called the "telephone," by means of which he could transmit speech over a wire electrically.

The emperor was at once keenly interested, asked if he might see the apparatus demonstrated, and was assured that he might. As a matter of course, the adjournment of the judges was postponed and they remained to watch while the unknown Boston scientist demonstrated to royalty his newly invented device.

Bell showed the emperor how to hold the receiver to his ear, then himself went away to another part of the building and spoke into the transmitter. Unknowingly, these scientists were about to witness one of the most dramatic—and most important—moments in telephone history. There was a little pause. Suddenly Dom Pedro straightened, astonishment written one very line of his face.

He Hears It "Talk"

"My God! it *talks!*" he exclaimed, in tones of little less than awe.

One after another the judges crowded forward, themselves now eager to try the apparatus to which the emperor had paid this simple but eloquent tribute. Until late in the evening they remained, alternately talking and listening. Joseph Henry was among the first to congratulate Bell upon his success. Thomson—afterward Lord Kelvin— was loud in his praise. To use a modern expression, the telephone had been "sold" to the world of science.

Bell Tells His Story

When the Telephone Pioneers of America held its first meeting in Boston on November 2 and 3, 1911, Professor Bell was present and delivered an address. During his talk he told a story of taking the telephone to the Philadelphia Exposition and exhibiting it in an inconspicuous corner.

"I had a school for vocal physiology in Boston. I was right in the midst of examinations. My pupils, those of the deaf teaching speech to the deaf, and I could not be bothered at that time by having to go to Philadelphia and attend the exhibition. However, we found, in connection with the exhibition, that all apparatus involving a necessity for

Emperor Dom Pedro Cries "My God! It Talks"

quiet was to be examined on Sunday, June 25; and so it was urged that Sunday would interfere less with my professional pursuits than another day. I agreed, therefore, to go down and spend Sunday, and no longer.

"I could not possibly stay any longer than that while in the midst of examinations. So I went down to Philadelphia, growling all the time at this interruption to my professional work, and I appeared in Philadelphia on Sunday, the 25th. I was an unknown man and looked around upon the celebrities who were judges there and trotted around after the judges at the exhibition while they examined this exhibit and that exhibit. My exhibit came last.

"Before they got to that it was announced that the judges were too tired to make any further examination that day and that the exhibit could be examined another day. That meant that the telephone would not be seen, for I was not going to come back another day. I was going right back to Boston.

Dom Pedro Knows Him

"And that was the way the matter stood,—when suddenly there was one man among the judges who happened to remember me by sight. That was no less a person than his Majesty Dom Pedro, the Emperor of Brazil. I had shown him what we had been doing in teaching speech to the deaf in Boston, had taken him around to the city school for the deaf and shown him the means of teaching speech, and when he saw me there he remembered me and came over and shook hands and said, 'Mr. Bell, how are the deaf mutes of Boston?'

"I said they were very well and told him that the next exhibit on the program was my exhibit. 'Come along,' he said, and he took my arm and walked off with me—and, of course, where an emperor led the way the other judges followed. And the telephone exhibit was saved.

"Well, I cannot tell very much about that exhibit, although it was the pivotal point on which the whole telephone turned in those days. If I had not had that exhibition there, it is very doubtful what the condition of the telephone would be today. But the Emperor of Brazil was the first one to bring that situation about at that time.

"I went off to my transmitting instrument in another part of the building, and a little iron box receiver—you probably all know what it was from diagram—was placed at the ear of the emperor. I told him to hold it to his ear, and then I heard afterwards what happened. I was not present at that end of the line. I went to the other end and was reciting 'To be or not to be, that is the question,' and so on, keeping up a continuous talk. I heard afterwards from my friend, Mr. William Hubbard, that the emperor held it up in a very indifferent way to his ear, and then suddenly started and said, 'My God! it talks!'

"And he put it down; and then Sir William Thomson took it up, and one after another in the crowd took it up and listened. I was in another part of the building shouting away to the membrane telephone that was the transmitter.

"Suddenly I heard a noise of people stamping along very heavily, approaching, and there was Dom Pedro, rushing along at a very un-emperor-like gait, followed by Sir William Thomson and a number of others, to see what I was doing at the other end. They were very much interested. But I had to go back to Boston and couldn't wait any longer. I went that very night."

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Foreign Shipments in 1877

IT will surprise many to know that as early as September and October, 1877, Bell telephones were sent from the Williams shop to China, Japan, Cuba, and France on request, although the first real central office in Boston was not established until February, 1878.

At that time Samuel Hubbard, brother of Gardiner G. Hubbard, was living in San Francisco and at his request telephones 550 and 551 were sent on September 25 to Bavier & Company, Yokohama, Japan.

On October 6 telephones 718 and 719 were sent to Havana, Cuba, in the name of Patrick and Carter, who were electrical manufacturers in Philadelphia.

Three days later box telephones 700, 701, and 702 were sent to Charles L. Gay, Paris, France, sub-agents in Europe for Gardiner G. Hubbard.

A short time later two telephones were sent to China at the request of Cheney Brothers, silk manufacturers, of South Manchester, Conn.

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Bell's First Patent

Because of its importance as a matter of historical accuracy, and to clear up some misunderstanding, the true chronology of Alexander Graham Bell's fundamental patent is given below.

February 14, 1876—Application filed.
March 3, 1876—Application allowed. (Bell's birthday.)
March 4, 1876—Final fee of $20 paid.
March 7, 1876—Patent granted and issued.

March 10, 1876—Thomas A. Watson heard Professor Bell say, "Mr. Watson, come here; I want you," the first complete sentence ever transmitted by telephone at No. 5 Exeter place, Boston.

Bell Made Talking Circuit with a Daisy

On August 1, 1877, five men gathered in the office of a young lawyer in Boston and formed the first business organization in the world to promote the telephone. Three months previously the first telephone had been leased for real money. It was nearly a year and a half after Bell's first patent had been granted.

That lawyer was Charles Eustis Hubbard. For nearly forty-nine years he has been connected with the telephone business. He is now the oldest official in the service and the only one of the original directors living. As a director of the American Telephone and Telegraph Company for many years, Mr. Hubbard maintains an office at 125 Milk street, Boston, and takes a deep interest in the development of a business that was started in his office and now covers the globe. Mr. Hubbard recalls the early days of the telephone in the following article.

By Charles Eustis Hubbard

ALTHOUGH the telephone is but fifty years old, there are few persons still living who were intimately connected with its early history. I cannot recall the exact date when I first met Alexander Graham Bell, but it was some time prior to his invention of the telephone.

CHARLES EUSTIS HUBBARD
Dean of living telephone officials

At that time he was giving lessons in lip reading to my niece, Mabel G. Hubbard, his future wife, who lost her hearing from an attack of scarlet fever when a young child. Mr. Bell was then working on a system of multiple telegraphy, and as my brother, Gardiner Greene Hubbard, had for years been advocating the adoption of postal telegraphy by our government, he was much interested in Mr. Bell's work.

Mr. Thomas Sanders had a deaf son, whom Mr. Bell also had as a pupil in lip reading, which brought the two fathers together and they joined in assisting Mr. Bell to obtain a patent for multiple telegraphy. In studying the theory of harmonic telegraphy, Bell at last succeeded in transmitting the human voice over a wire.

My first introduction to the telephone was one evening, in the attic of a small boarding house in Rowe street place, Boston, where Mr. Bell and his assistant, Thomas A. Watson, were living. I distinctly remember hanging up some blankets and counterpanes to deaden the sounds, so that the shouting into the box transmitter, placed in one room, the hand receiver being in the other room, would not disturb the people downstairs. Years afterwards I talked with Mr. Watson, he in San Francisco, I in Boston.

The Business Starts

After the issue of the patent in March, 1876, and the now famous exhibition of the crude instruments at the Centennial at Philadelphia in the summer of 1876, a small business was started and in the summer of 1877 I drew up the first articles of association, called The Bell Telephone Association.

The first meeting was held August 1, 1877, at my office in the Sears Building, corner of Washington and Court streets, Boston. Five persons were present at the meeting, Gardiner G. Hubbard, Thomas Sanders, Thomas A. Watson, Alexander Graham Bell and myself.

The first business was my election as clerk of the meeting, so that I am the oldest official in the service and the only one of the original directors left.

MR. HUBBARD IN 1877

There were seven shareholders, Alexander Graham Bell, Mabel G. Bell, Gardiner G. Hubbard, Gertrude McC. Hubbard, Thomas Sanders, Thomas A. Watson and Charles Eustis Hubbard. I made out the seven certificates of stock.

There are now, as of January 2, 1926, 362,179 stockholders. Certainly a unique record.

I also organized the New England Telephone Company, the Bell Telephone Company, the National Bell Telephone Company and the American Bell Telephone Company, and was clerk and director of all, with the exception of an interim of a few months when absent in Europe. I was the only clerk of the American Bell Telephone Company and for many years secretary of the American Telephone and Telegraph Company until retired on account of age, and am still a director.

In the early days of the telephone, I witnessed a very interesting experiment, which showed the wonderful delicacy of the instrument. Before the use of the metallic circuit, the earth formed a part of the circuit, and in house installation, one wire was connected to a gas or water pipe to obtain a ground connection and the other passed through the air, over the roofs of the buildings in cities and towns to the receiving station.

Mr. Bell had brought to Mr. Gardiner Hubbard's place in Cambridge a pair of hand telephones, even at that early day almost identical with the receiver now in use, and connected the two instruments by a wire about eighty feet long, attached to one of the binding posts. A short naked wire was fastened to the other post.

Mr. Bell took one telephone in his hand, holding the short naked wire in the other hand. His assistant, Mr. Frederic Gower, did the same with the second telephone. Then standing apart on the lawn the full length of the long wire, they talked, as did I, the talker using his telephone as a transmitter, the listener his as a receiver, the circuit being completed through their bodies and the earth.

Recalls Old Boston

Mr. Bell then stood on a board, a non-conductor, and the circuit was broken. Then, still standing on the board, he reached out his foot and touched a daisy, again completing the circuit and the speech passed over the wire.

I also recall going on to the roof of a house in Washington about 1878 or 1879, with Mr. Bell, and watching him attempt to talk over a ray of light by the use of silenium, an anticipation of the radio.

My memory covers a long period of time. A native of Boston, born on Tremont street, opposite the Granary burying ground, I can remember when there were only pumps in the houses and only oil lamps and candles were used for lighting.

On looking back over all the changes that have taken place in my long life, I can think of no one thing that has had a greater influence in the progress of mankind than the telephone. It has revolutionized the conduct of business and annihilated space. The radio is marvellous beyond words, but without the telephone there could be no radio. It progresses by leaps and bounds. No one can foretell what the future has in store for us, but the telephone will never cease to be one of the greatest wonders of the world.

Augusta, Ga.

Telephone Despatch Co.

(BELL'S PATENT.)

General Business Offices

No. 342 WASHINGTON STREET.

E. T. Holmes, Manager.

The above Company possesses, and is now prepared, to establish direct TELEPHONIC Communication between each and every business house in the City. Whatever inquiry you wish to make, however you wish to transact, or message you wish to communicate with any other business house or profession in the City, can be done while seated at your desk. This is done by communicating through the Telephone, to a Central Office, that you desire to speak to Mr. A., B. or C. In an instant your communication is made direct and complete, and you can carry on your conversation, — which it is impossible for a third party to overhear, — again signaling the Central Office when you are through.

Every Bank, Office, Business House and Profession in this City are expected to connect with this Central Office System.

THE FOLLOWING FIRMS HAVE ALREADY SUBSCRIBED.

Agricultural. Furniture. Patent Solicitors.

Banks. Pickles, Preserves, &c.

Bankers. Glass. Printers.

Boots and Shoes. Grocers. Publishers.

Brass Goods. Hardware. Hats.

Carpets. Iron and Steel. Rectifiers.

Carriages. Iron and Steel. Salt Cutters.

Clothing. Lawyers. Wares.

Confectioners. Spiral Cutlery.

China, Glass & Earthenware. Steamers.

Drugs. Tobacco Manufactories. Steamship Lines.

Dry Goods. Tailors' Trimmings.

Woolens.

FIRST BOSTON DIRECTORY IN OCTOBER, 1878

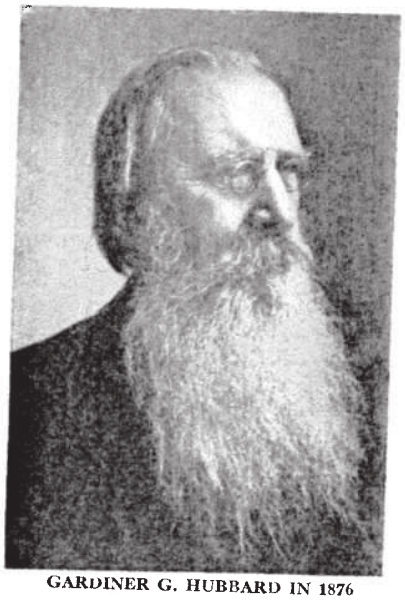
Founders of the Business

First Three Men in the World to Give Bell Financial Support and Advice

Mr. Hubbard was a Cambridge lawyer who developed the business side of the telephone. Bell married his daughter.

Mr. Williams owned the shop where Bell worked on his invention and where the early telephones were developed.

Mr. Sanders was a leather merchant living in Haverhill. He was the first man to loan Bell any considerable amount of money.



GARDINER G. HUBBARD IN 1876

CHARLES WILLIAMS, JR., IN 1876

THOMAS SANDERS IN 1876

FOUR men, with little in common except a capacity for almost superhuman faith, laid the foundations of the vast organization which today provides America with a nation-wide telephone service.

These four men were the telephone's inventor, Alexander Graham Bell; his young assistant, Thomas A. Watson; and two hard-headed New England business men, Thomas Sanders and Gardiner G. Hubbard. It was they who, sixteen months after the original telephone patent had been granted, undertook the development of Bell's invention on a business basis.

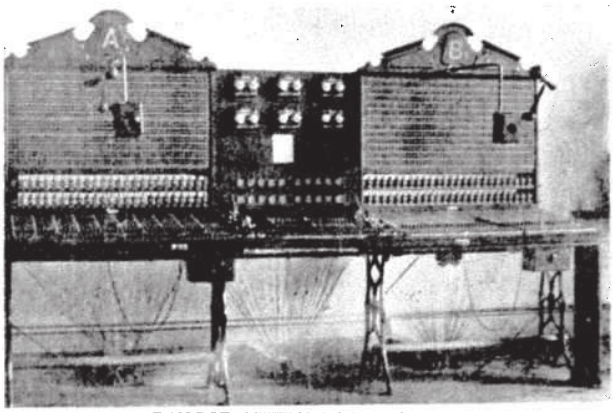
Each gave to the enterprise his own unique contribution: Bell, the imaginative, who had drawn aside the curtain and revealed the principle of the electrical transmission of speech; Watson, the practical, skilled of hand and filled with the pride of a true craftsman in a job well done, who had transformed Bell's vision into an instrument which really talked; Sanders, the substantial man of means, who had given of his substance, and given again and again, in order that the telephone —but a puny child at first—might not die in infancy; Hubbard, the man of personality, of enthusiasm, with a wide circle of influential acquaintances and the knack of making use of them when difficult things were to be accomplished.

Bell Telephone Company Formed

The "harmonic telegraph," in which Bell's two backers showed the greatest interest and on which, at their insistent direction, he was working in June, 1875, when he discovered the principle of telephony, was in itself a distinct failure. But by the summer of 1877 the success of the telephone had made it apparent that the time had come for something more substantial in the way of organization than the loosely knit relationship that had existed between these three men.

Watson had been taken into the "association" the previous September and now, on July 9, 1877, an agreement was entered into whereby the interests of his fellows were transferred to Hubbard, the legal title of the organization thus formed being "The Bell Telephone Company, Gardiner G. Hubbard, Trustee."

In 1879 these two companies were combined



BANGOR SWITCHBOARD OF 1883

under the name of the National Bell Telephone Company.

In 1880 the American Bell Telephone Company was formed which took over all the rights and property of the National Bell Telephone Company.

Soon after the formation of this company the original Bell associates, Dr. Bell, Hubbard, Sanders and Watson, withdrew from the telephone business.

In 1899 the American Bell Telephone Company was merged with the American Telephone and Telegraph Company which had been organized in 1885 to develop and handle the long-distance traffic.

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A Great Telephone City

IF ALL the Bell-owned buildings were grouped together, they would make a business community with five hundred more buildings than the total number of office buildings in New York City, as classified by the department of taxes and assessments.

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Nearly 40,000 Telephone Companies

THE Associated Companies, twenty-five in number, own and operate the local telephone exchanges and toll lines. They connect with over 9,000 independent telephone companies and over 28,000 rural lines and associations.

△ △ △

Spanning the Earth with Pole Lines

THE Bell System also owns pole lines which would reach over fifteen times around the world; and duct space for carrying cables underground of sufficient length to reach more than nine times through the center of the earth from pole to pole.

First Telephone Users

AFTER nearly three years of experimenting, the telephone was put on a commercial basis in May, 1877. The first three men to recognize the practical value of telephone service and agree to pay for it were Roswell C. Downer of Somerville, James Emery, Jr., of Charlestown, and James R. Osgood of Boston.

Downer, a banker, was the first commercial user; Emery, a wholesale fish dealer, the second; and Osgood, the book publisher, the third. Emery was the first to make actual cash payment.

The Downer, Emery, and Osgood telephones were not installed for experimental or demonstration purposes, as several others previously had been. Downer got his because he was intensely interested in the new invention and believed it would be a convenience between the home and office. Emery leased his telephones as a means of communication with his brothers who lived but a short distance away.

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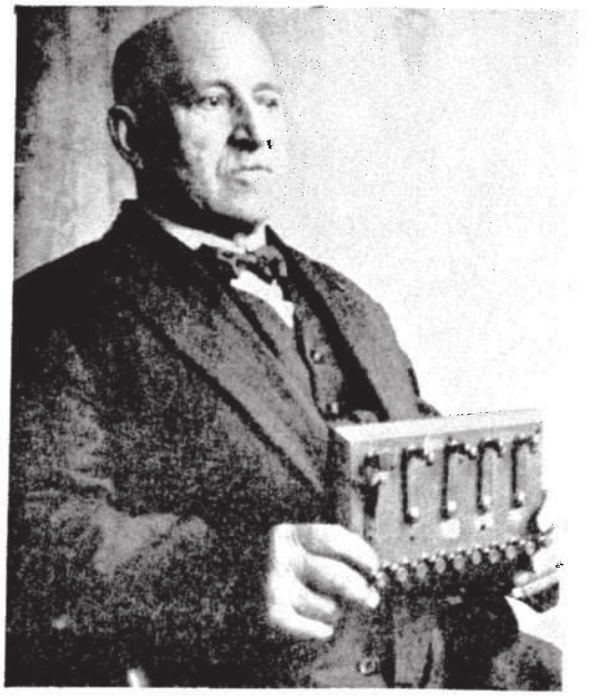
Telephone Growth Per Capita

1900—One to 90 persons.
1905—One to 34 persons.
1910—One to 16 persons.
1915—One to 11 persons.
1921—One to 8 persons.
1926—One to 7 persons.



C. H. COX
Haverhill Subscriber—with first Haverhill switchboard

Talking Around the World — A Forecast

Forty-seven years ago a boy named John J. Carty was obliged to leave the Cambridge High School because of his eyesight. He went to work in Boston for fifty cents a day. Then he got a job with the Telephone Despatch Company. From then on he climbed the ladder, until he became chief engineer of the American Telephone and Telegraph Company, and vice-president in charge of research and development. Today he is universally recognized as the greatest telephone engineer in the world. In the *Bell Telephone Quarterly* for January, 1926, there is an article on "The Semi-Centennial of the Telephone," from which the extracts printed below are taken.

By John J. Carty

THE progress which has been made during the last fifty years justifies the belief that in due course science will find the way to construct a telephone system connecting the entire world, so that the tens of millions of telephone users in the United States can readily talk, not only as they now do among themselves, but also with any one else who has a telephone, wherever he may be located on the face of the earth.

The use of the spoken word to convey ideas distinguishes man from all other created things, and the degree of its extension by the use of the telephone, among the people of a nation, indicates in some measure the advance they have made in civilization. For their achievements in the spoken word, Greece and Rome have placed among the immortals the names of the greatest orators, and in modern times the nations have assigned to their masters of speech a foremost place. It is not too much to expect that history will accord to our country the first place among the nations for its contributions to the extension of the spoken word throughout both space and time. As the ancients have honored Demosthenes and Cicero, so will the names of Bell and Edison be perpetuated for their immortal achievements, the telephone and the phonograph—the one transmitting the spoken word across continents and oceans, and the other transmitting the tones of the human voice to generations yet unborn.

JOHN J. CARTY

Example of Achievement

Under the leadership of Hubbard and Sanders and Forbes and Vail, there began the development of the Bell System, which after fifty years has become the greatest single business institution in America—an outstanding example to all the world of what can be achieved by the cooperation of science and business.

The laboratory in which worked Bell and Watson has grown until now it has a personnel of over 3,000 including engineers and scientists of the highest attainments; and counting these and the other trained specialists at the headquarters of the Bell System at New York, there are constantly employed 5,000 men—scientific and business specialists—whose sole duty it is to advance the telephone art and discover new ways of increasing its usefulness to the public.

Distributed through the various states of the Union there are thousands of other engineers engaged in construction and operation; and in the hundreds of different branches of telephone activity which have developed with the growth of the system, there are over 320,000 men and women employed each day in the telephone service.

The first telephone message was sent in 1876. So great has been the growth of telephone messages in fifty years that in 1926, 50,000,000 telephone conversations take place each day in the vast telephone plant which covers a continent.

The two telephones of 1876 have increased so that now there are more than 16,000,000 telephones interconnected in the Bell System.

The first telephone line of thirty feet in length has grown to a net-work of more than forty million miles of wire; and switchboards, buildings, pole lines, cables, conduits, and other forms of plant have been constructed, costing over $2,500,000,000.

During the year 1926 will be observed with appropriate ceremonies the semi-centennial of the invention of the telephone. Much will be said and written concerning the marvels which have been

achieved during the past fifty years, in extending its use among all the people of our nation by means of a continental system of wires and by the most recent marvel of the radio. These things are largely dependent upon the fundamental discovery which was made by Alexander Graham Bell and upon the unremitting labors of the scientific men in those laboratories founded by him fifty years ago and which bear his name.

So much has been achieved during the last half century in the scientific and business development of the telephone in America, that we can look forward with a confidence born of experience to the astonishing things that will have been accomplished by the successors of Bell at the end of the next fifty years, when our country celebrates the second hundred years of its existence as a nation.

While it is impossible to predict in detail what will be the nature of these great new developments, we can be sure that the problems which we can now see ahead of us contain the promise of marvels greater than anything which we can now imagine.

As recently stated by Mr. W. S. Gifford, president of the American Telephone and Telegraph Company: "The advances which have been made during the first fifty years of the work of the Bell System are unparalleled in the history of communications. They are contributions which will make forever memorable this great epoch in our progress. We are now at the beginning of a new era filled with boundless opportunities for advancement in the business and science of telephony. Upon the foundations which have been so securely laid, we can look forward to the telephone system of the future which, in effectiveness and useful service, will surpass all that has gone before."

Voices Across the Sea

A long looked for consummation has come at last with yesterday's news that, as a result of experiments carried on by the British government and the American Telephone & Telegraph Company, wireless telephony is now possible between the United States and Great Britain. For three years past America has been communicating with England by radio, but this is the first time New Yorkers have ever been able to receive a wireless telephone message from the "right little, tight little island." The voices which thus came across the Atlantic are said to have been heard clearly, and the outlook is so promising that the American Company already forecasts the early establishment of a regular transatlantic wireless telephone service.

(From The Boston Herald)

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Future Prospects

THE Bell System has successfully passed through financial panics of the past, the period of the war, and the industrial difficulties of the years which followed.

It serves the country by means of a modern plant which is worth today more than it cost and far more than the outstanding stock and bonds.

Its business is steadily increasing and its facilities are being enlarged and extended in proportion. Even in times of business depression it has not suffered any substantial retardation of its normal growth, a fact which permits the conclusion that the value of the service to the users even in times of adversity is much greater than the price that is charged for it.

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In 1900 there was an average of three telephone conversations per month for every person in the United States.

ENGLAND HEARD BY WIRELESS

"Other Side" Voices Come Across in Fine Style

NEW YORK, Feb. 13 (AP).—England has talked to America by wireless telephone for the first time in joint experiments carried on by the British government and the American Telephone & Telegraph Company.

Voices carried clearly across the Atlantic and were heard in New York as though they came from another part of the United States.

USE ORDINARY PHONES

Although the United States has been talking to England by wireless for three years, W. B. Banning, of the telephone company, asserted this is the first time that England has been able to reply in wireless telephone. The voices were broadcast from a new powerful radio station which has just been opened at Rugby.

Engineers in both New York and London talked into ordinary telephone apparatus. In England the voices were relayed by telephone wires to Rugby and were picked up in America at the Radio Corporation's station at Riverhead, N. Y., and the telephone company station at Houlton, Me., being carried to New York over telephone wires.

Although the experiment was a success, transmission of overseas conversation has not yet reached the stage of perfection required for public use, Mr. Banning said. He added, however, that it was hoped soon to establish a regular transatlantic service.

(From The Boston Post)